Motorship

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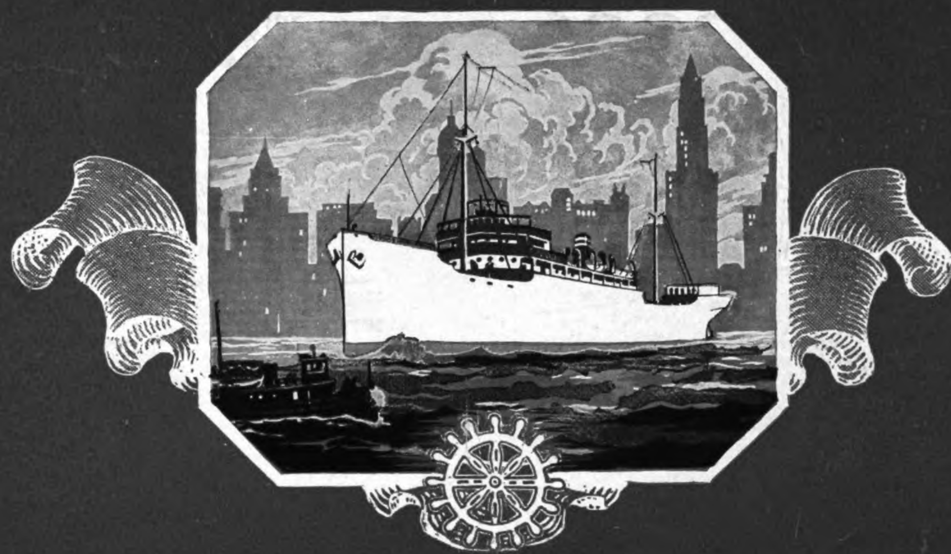

APR., 1928

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Motorship

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Volume XIII — **April, 1928** — **Number 4**

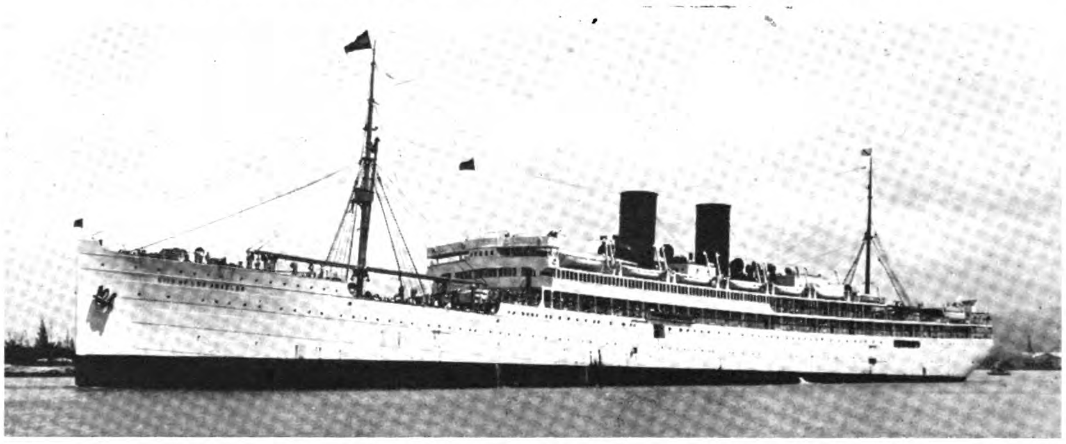
Why Diesels Should Be Fitted in the Ex-German Liner Mt. Vernon

IT is exactly a year ago since MOTORSHIP first drew attention to the possibility of putting some form of Diesel power into the ex-German passenger liners MOUNT VERNON and AGAMEMNON. We returned to the same issue again in June when we put out tentative propositions for Diesel-electrification of these ships, publishing plans of the ships as they exist at present and inviting manufacturers to submit opinions.

We have felt, and we still feel, that in these two ships there are two motor passenger liners of tremendous potential value.

America has no motor liners. Twelve operators of other nations now operate 22, and the success of these initial motor liners is established by existing and potential orders. One big shipowning concern is building a total of 18 motorships out of a total constructional program of 20 new ships.

"... Results Satisfactory and Expect Another 15 Years' Service ..."



Above is the opinion of M. H. Sherman, President of the Los Angeles Ss. Co., as to the 28-year-old City of Los Angeles, gutted and rebuilt for Hawaiian Service—Why not recondition the Mount Vernon?

There are four large motor liners under construction in Europe now for North Atlantic service. As the venture of building a motor liner of 20,000 to 30,000 gross tons, and 18 to 20 knots speed, calls for an expenditure of upwards of $10,000,000, such a large number of these ships would not have been laid down unless amply justified by the performance of those first placed in service.

Even the most pessimistic opponents of the Diesel driven ship cannot be other than enthusiastic over the possibilities presented by the recently proposed Dieselization of the S. S. MT. VERNON of the United States Shipping Board, and thus obtaining, at an additional expense estimated at only $1,000,000 above the cost of reconditioning as a steamer, one of the highest powered and fastest motorships in the world.

Investigation of the present condition of the MT. VERNON and MONTICELLO reveals that the hulls, due to the use of rustproof iron instead of the usual steel in their construction, are in perfect condition; but the steam machinery must be scrapped and replaced in order to render these vessels fit for Atlantic passenger service. New boilers and turbines have been considered for both vessels at an estimated reconditioning expense of $6,000,000 each. Substituting Diesel engines for the new propelling equipment of the MT. VERNON would entail an additional cost of not over $1,000,000,—and would provide the United States Lines with a "passenger pulling" vessel, a unique ship—one of the highest powered, and fastest motorliners in the world.

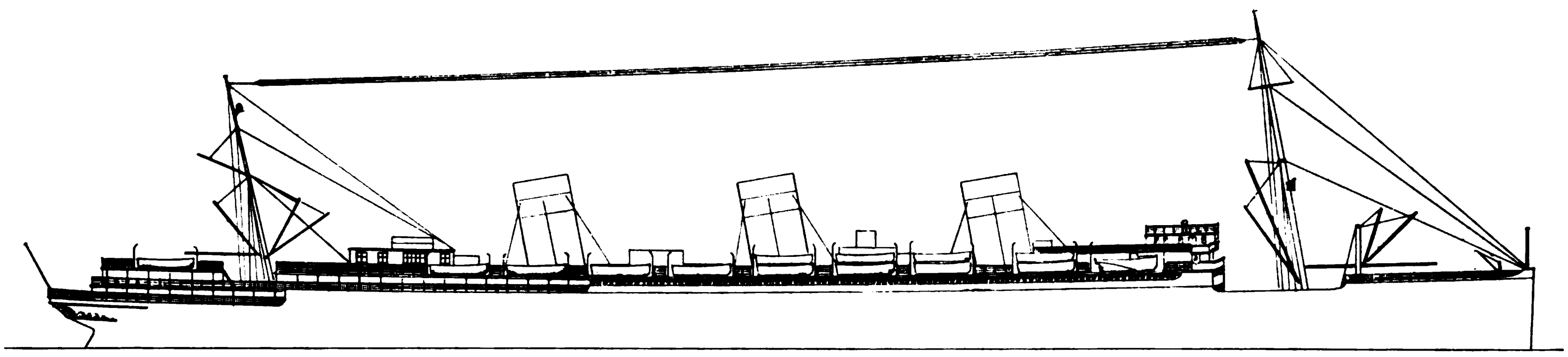
In contrast, the same vessel reconditioned as a steamer would remain only that—a rebuilt passenger steamer—lacking that appeal to passengers that "something new" in shipping has to those going abroad, either "first timers" or "old timers."

The real merit of fitting Diesels in the MT. VERNON lies in the saving in fuel consumption, estimated at $125,000 per year—a liberal return on the additional expenditure of $1,000,000. Also, it has been considered that sufficient cheap fuel oil could be carried in excess of that required for the round voyage to refuel the LEVIATHAN on the British side, and eliminate the necessity for purchasing fuel at higher prices, the smaller space and weight of the Diesel installation permitting greater bunker capacity. It should be distinctly remembered in this connection, however, that the Dieselization will necessarily represent only a portion of the total expenditure. The ships, to be lined up with modern requirements, must be completely gutted and rebuilt internally. The superstructure must be reconstructed.

Briefly, it is proposed to remove from the two ships all existing machinery and boilers and to employ some of the 395.5 ft. total existing machinery space length in fitting four main Diesels and probably ten Diesels driving generator sets to supply power for all auxiliary purposes on the ship—driving winches, windlass, pumps, lighting, etc.

Each main engine will occupy almost exactly the space taken by each of the four existing steam reciprocating engines, and it is stated furthermore that the existing tank top and tank structure in way of the machinery is suitable for Diesel machinery with very little modification. It was designed for high speed reciprocating machinery anyway.

It should here be mentioned that the reciprocating machinery of the MT. VERNON and her sisters is housed in four separate engine rooms. Actually the main engine space is one big space 102 ft. 6 in. long but it is divided into four by longitudinal and transverse bulkheads. This was done partly for flooding reasons and partly for strategic reasons, because the vessels



M. S. MONTICELLO AND MOUNT VERNON

were intended by their German owners to operate as auxiliary cruisers. The new plan leaves the bulkheads in place, and furthermore still uses two tandem engines in each main propeller shaft. These will be suitably coupled and arranged for uncoupling should it be necessary to cruise on two engines only.

Forward of the machinery space there is some 293 ft. of boiler room space available for auxiliary Diesels and for fuel cross bunkers. It is extremely improbable that all this space will be required for the new machinery which may leave space available for cargo. Indeed, so compact—compared with the old steam installations—is the Diesel plant that, as a motorship, the MT. VERNON will not only be able to carry sufficient fuel for the round voyage from New York to Southampton and back but also, as has been mentioned, will be enabled to carry extra fuel which can be used for the LEVIATHAN on the British side. The LEVIATHAN, being a steamer of very high power, uses so much fuel oil per trip that in common with the other ocean mammoths she has to fuel in port at each end of her voyage.

Compactness can logically be urged as one of the principal pleas for the Dieselization of these two ships. When we realize the enormous space taken up by the existing steam machinery—293 ft. of boilers and 102.5 ft. of steam engines, we begin to see why shipowners are giving earnest consideration to the Diesel in new passenger engine design.

Fuel economy (25 per cent of that of the steamer) putting of reciprocating machinery in hulls already designed for this type of machinery, a net lowering of the centre of gravity of the ship with improvement in stability, cleanliness, and modernization ....these are all points of advantage which the Diesel proposition will allow.

It has been argued that it is criminal to spend a sum of $12,000,000 on modernizing hulls which are 20 and 27 years old respectively. So it is—if you can get money for new construction, but this up to the present seems out of the question. Moreover, it is sheer folly to cavil at an expenditure of $12,000,000 which will give something really constructive to the American Merchant Marine and will help, in transatlantic service, to maintain a balanced service, when it is proposed lightheartedly to use $94,000,000 upon another transatlantic scheme of extremely problematic value. In a normal case ships 28 years old are sold to ship-breakers. In this special case they are valuable.

The hulls are in good condition, we are assured, although the interior arrangements are hopelessly out of date. We have a valuable precedent, too, in the case of the ex-German liner PRESIDENT ARTHUR which has been rebuilt for the Los Angeles Steamship Co. for service between Los Angeles and the Hawaiian Islands, and which, as the CITY OF LOS ANGELES, is considered fit for another 15 years service. This vessel was built in Germany in 1900.

It is worthy of record that no one accused her present owners of being crazy when they decided to recondition her, and yet they were doing nothing worse than the Shipping Board is now proposing.

As a matter of fact, the North Atlantic is not overstocked with Cabin Class ships of modern economical type at the present time and the popularity of Cabin Class ships is an ever increasing one. As a motorship either the MT. VERNON or her sister could easily out-economize many existing ships. They could carry a valuable amount of freight, about 5000 tons per ship.

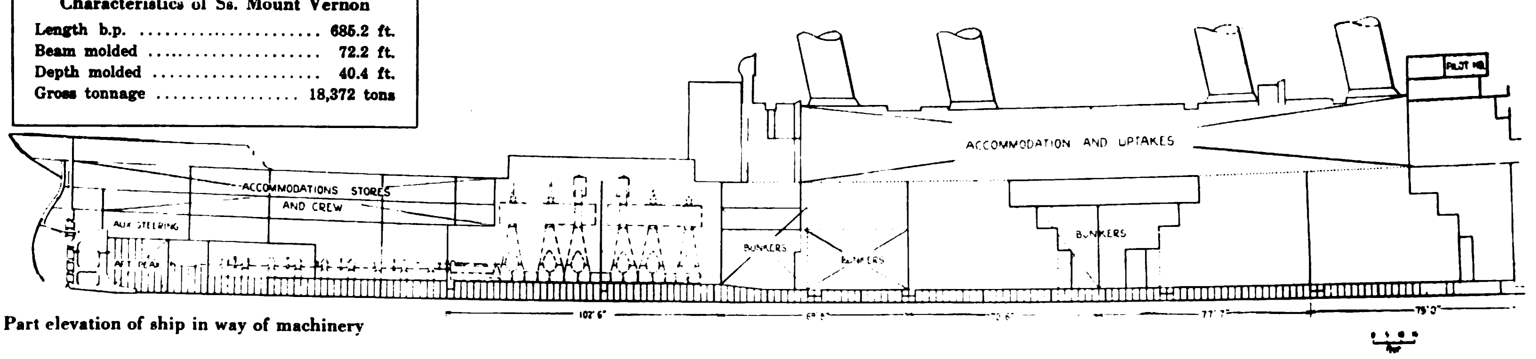
Their operating economy and efficiency would give to the American marine Diesel such publicity that, regardless of the actual builders of the machinery, a tremendous impetus would be given to the industry as a whole.

The initial Dieselization program of the Shipping Board has resulted in the development of double-acting cylinder sizes which, in a large number of cylinders, will produce the required aggregate horsepower without attempting new development; which practically eliminates experimental features from such an installation. In fact the 28,000 horsepower motorliner AUGUSTUS has engines of exactly the same type and cylinder dimensions as those already made in America for Shipping Board freighters now in successful operation.

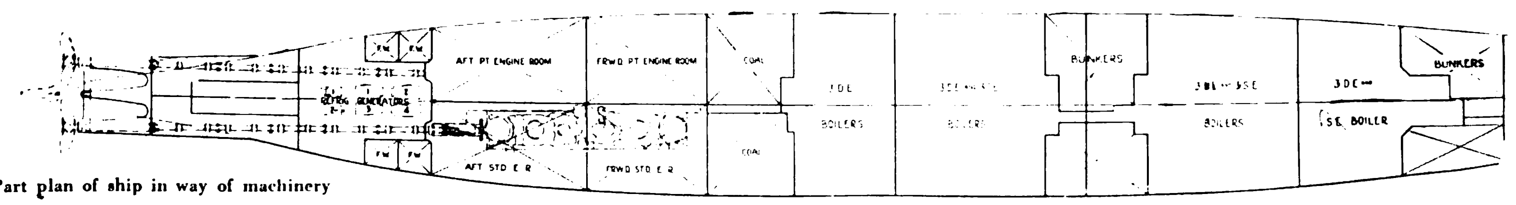
The present bill before Congress provides $12,000,000 for reconditioning the MT. VERNON and MONTICELLO. By installing Diesels in the MT. VERNON an excellent comparison of the actual advantages of the motorship and steamer will be possible. The fuel saving of the motorship is estimated at $125,000 per annum.

Characteristics of Ss. Mount Vernon

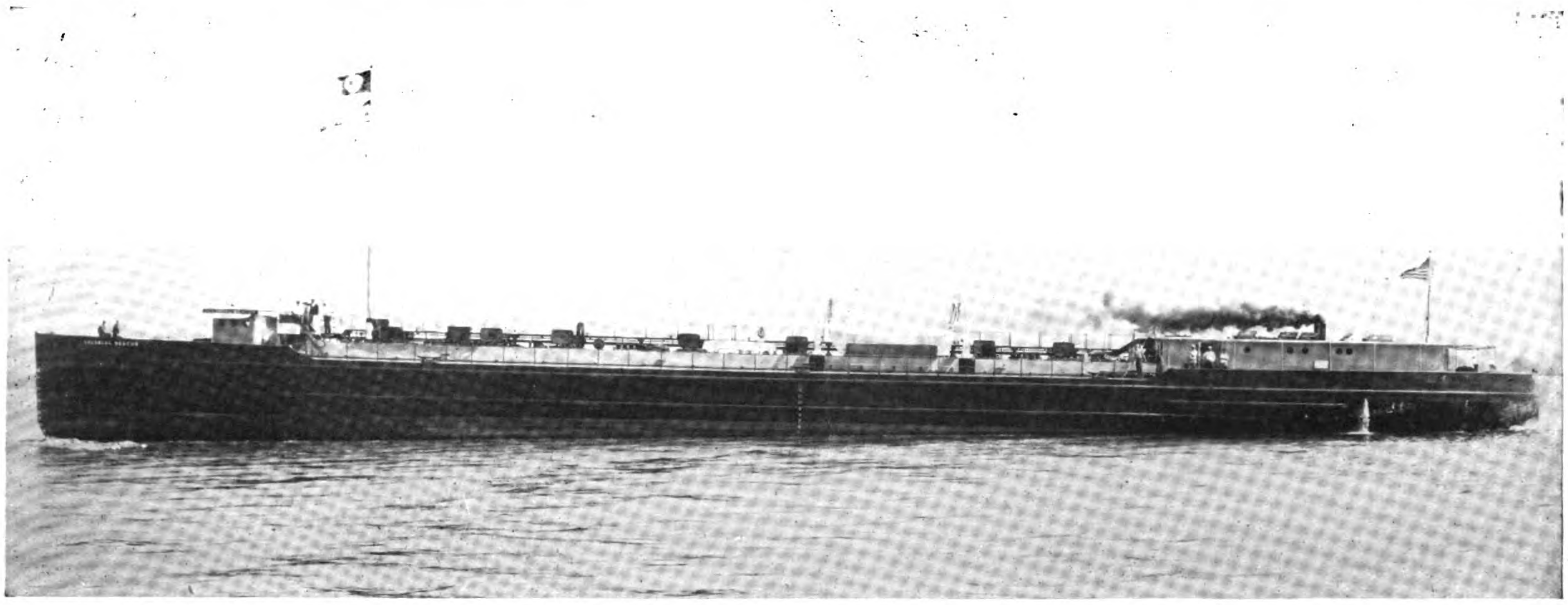
Length b.p.	685.2 ft.
Beam molded	72.2 ft.
Depth molded	40.4 ft.
Gross tonnage	18,372 tons



Part elevation of ship in way of machinery



Part plan of ship in way of machinery



Coastwise and Sound Motor Tankers

Diesel Engines Have Created a Large Field in Special Type Fast Tankers for Gasoline and Light Oils

AMERICA has evolved her own type of tanker for coastwise, sound, and canal carriage of gasoline and fuel oils in bulk. This type combines many of the characteristics of the canal freighter operating on the Great Lakes (as regards the hull), with the hull strength of a sea-going freighter of moderate size. In addition all superstructures are kept low in order that such ships may navigate under bridges on the New York State Barge Canal system. A number of such vessels have been built by the Sun Sb. Co., Chester, Pa., during the last year or so.

Ms. COLONIAL BEACON, built at Chester for the Beacon Oil Co. of Boston, is an example of recent construction in that type of ship. She is powered by two 360 hp. 6-cylinder Fairbanks Morse Diesels. She is also equipped with two 50 kw. and one 18 kw. F-M Diesel generating sets for supplying current for the auxiliaries and for the cargo pumps. The tanker was designed to carry gasoline and light oils from the refineries at tide water along the coast to inland distributing points. For that reason the vessel is unusually low and has a removable mast and removable exhaust stacks so that it will be possible for it to pass under barge canal bridges, as has been mentioned.

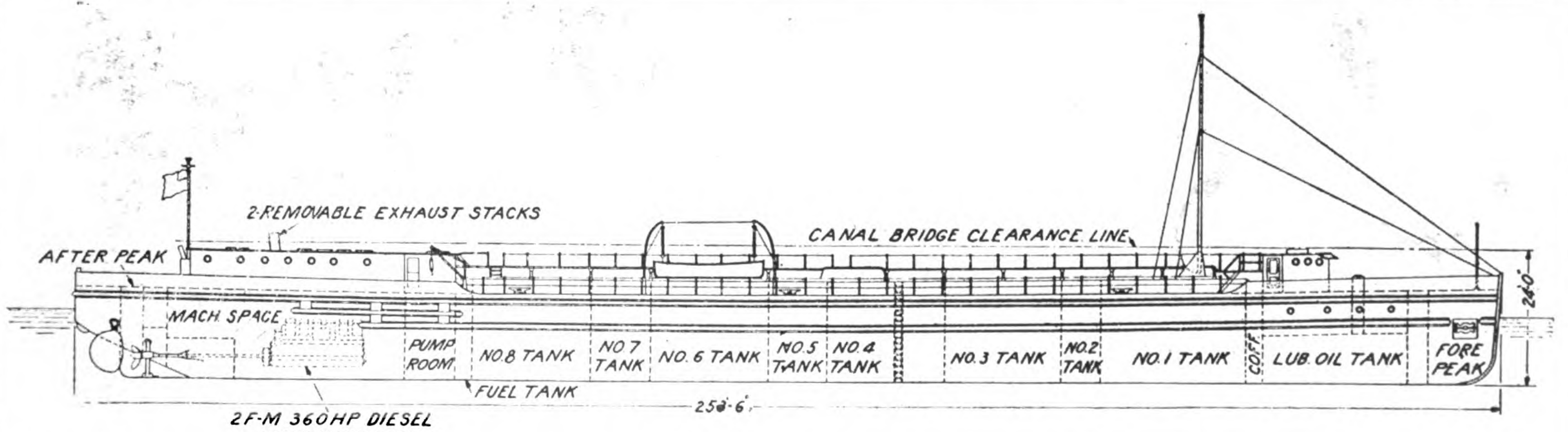
The lighting arrangements on the COLONIAL BEACON have no unusual features, but the heating load is unusually heavy because electric current is used exclusively for cooking and for heating crew's quarters. It is for this reason that at least one of the 50 kw. Diesel generators must always be kept running so long as there is a crew on board; for lay-up service the 18 kw. Diesel set is sufficient to supply all necessary lighting and minor services such as bilge pumping.

Characteristics of Colonial Beacon

Length bp.	263 ft. 6 in.
Beam mld.	40 ft. 0 in.
Depth mld.	15 ft. 0 in.
Draft (load)	12 ft. 0 in.
Power (total)	720 hp.

It is of the utmost importance for tanker service that fire hazards of all kinds can be eliminated by the use of high-compression, cold starting Diesel engines. As noted above, even the galley above is replaced by flameless heat—a godsend for the crews of such a potential floating volcano as a gasoline-loaded boat. Electric cooking may possibly be objected to on the score of expense, the general impression being that such service is intended only for millionaire's houses. But on a motorship with Diesel-electric auxiliaries the expense for heating simmers down to the bare fuel cost; the units must be provided anyway for other purposes so that their overhead is accounted for otherwise than by the heating service. Half a cent per kilowatt-hour is about the maximum cost. With the high efficiency attained by modern electric heating devices the 3,410 B.t.u. represented by each kilowatt-hour go at least as far as the 12,000 odd B.t.u. available in the fuel required by the Diesel generator to produce it. Besides the figures for efficiency, there are many considerations such as being able to shut the heat off instantly when no longer wanted, the possibility of regulating it to a nicety, and its concentration at the spot where it is wanted, that make the Diesel-electric B.t.u. actually cheaper than an equivalent B.t.u. produced in an oil or coal-fired range.

Ample generating capacity for the heating is on hand because the amount of installed auxiliary power is governed primarily by the requirements for cargo handling. As is well known, all tankers are operated on a quick turn-around, and the length of their stays in port is cut down



Inboard profile, which may be taken as typical, of small tanker for work on the New York State Barge Canal, coastwise or in sound service

as much as possible by the installation of large-capacity cargo pumps. The yearly ton miles credited to any tanker depend not only on the main propelling machinery, but also on the capacity of the cargo-handling auxiliaries. The two cargo pumps on the COLONIAL BEACON are each driven through worm gearing by 50 hp. electric motors. From this it follows that the proportion of cargo-handling power to the main propelling power is about

$$100 \times \frac{2 \times 50}{2 \times 360} = 14 \text{ per cent, while}$$

the proportion of all auxiliary generating power to main power is

$$100 \times \frac{30 + 2 \times 75}{2 \times 360} = 25 \text{ per cent}$$

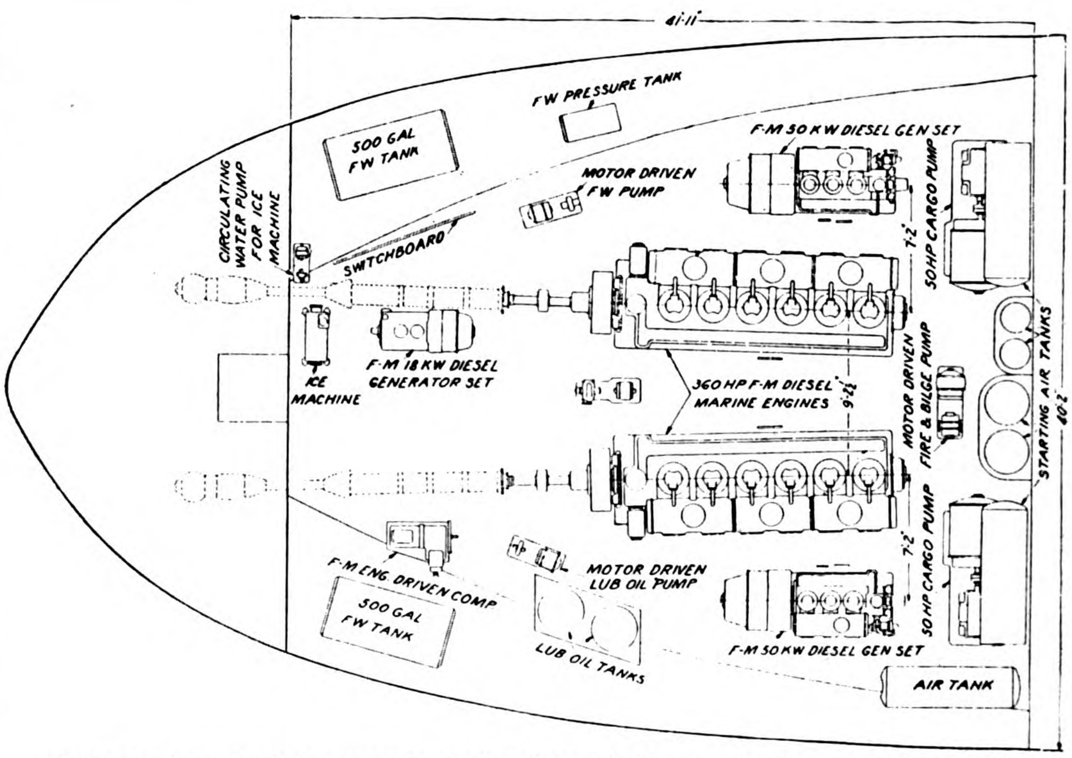
Naturally this figure is high because it applies to a tanker; on a cargo vessel it would be more in the neighborhood of 15-18 per cent depending on the service.

The cargo-handling load is the measure for the amount of auxiliary power no matter whether the vessel handles liquid or dry cargo; in the latter case the installed power of the deck-winches corresponds to the capacity of a tanker's pumping installation. Deck machinery for dry cargo motor vessels is also being electrified at a rate that threatens to supersede all other forms of power. The most important difference between the portion of auxiliary power on a dry-cargo ship and the tanker is due to the fact that the turn-around of many general cargo motorships is not so completely determined by the speed of loading and unloading.

Once the amount of power for cargo-handling has been determined, there is no need for specially computing the load due to the engine-room service, beyond making sure that the auxiliary engines are of such a size as to obviate the necessity for operating more than one of them while at sea.

The Fairbanks-Morse main engines have their own attached circulating water pumps and maneuvering air compressors. Their air compressors are direct-driven through large eccentrics on the crankshafts, while a double-acting, crosshead type circulating pump, also the lubricating oil transfer pumps are linked to the compressor eccentric rod. As the basis of the main engine lubricating system is a multi-feed positive mechanical oiler, the duty of the main engine lubricating oil pumps is light, consisting mainly of handling the oil drainage from the crankpits and the transfer of oil to the filter and lay-shaft bearings. The fuel supply to the injection pumps is handled by a low-pressure elevating pump direct-driven from the lay-shaft.

The capacity of the main engine compressor is ample for all ordinary maneuvering air compressor requirements. But it sometimes happens that the "bells" come so thick and fast that a compressor of an uneconomically large size would have to be on the engine in order to handle it. This contingency is adequately taken care of on the COLONIAL BEACON by the compressors fitted to the two 50 kw. Fairbanks-Morse auxiliary Diesel generators.



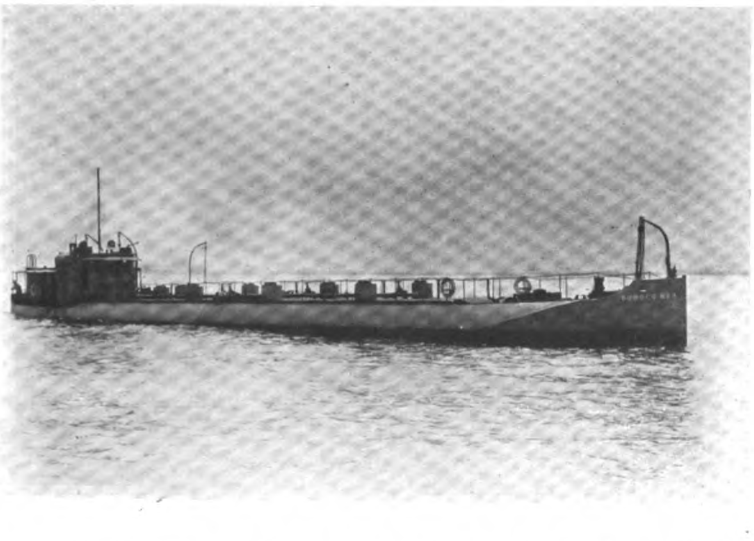
Machinery layout of the coastwise tanker Colonial Beacon, showing two 360 hp. Diesels

Development in Ventilated Piston Rings

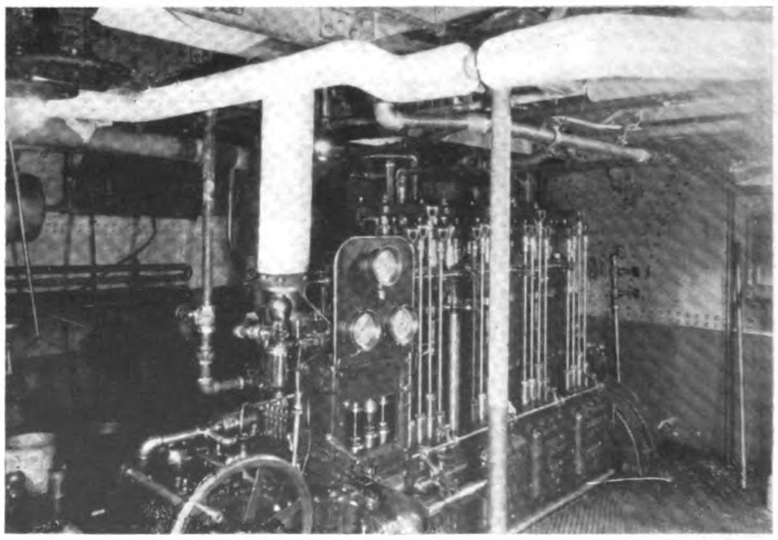
American Hammered Piston Ring Co., Baltimore, Md., announces the perfection of a new type of ventilated piston ring, characterized by large closely spaced slots through the center. Above and below these slots are annular grooves. The ring is hammered to establish the tension so important in an oil control ring.

As these rings have been designed particularly for modern high speed motors, there are four scraping edges to remove excess oil from the cylinder walls. The large vents drain off the excess oil very rapidly because the tension created by the hammering operation holds the scraping edges in firm contact with the cylinder walls at all speeds. The two annular grooves retain an ample supply of oil for lubrication at high speeds.

Coastwise Tanker Converted from Gasoline to Diesel Drive



Sunoco No. 4 powered by Diesels at the Sun Sb. Co.'s plant, Chester



A 150 hp. Bessemer Diesel which has replaced gasoline engine drive

An 18-Motorship Passenger-Cargo Fleet

Survey of Present Hapag Building Activities Reveals Large and Diverse Diesel Engine Application on Modern Ships

By A. C. Hardy, B.Sc.

(Author "Motorships," "Motorshipping," Etc.)

ONE of the most outstanding features in motorshipping development today is the extent to which the world's major shipping companies are adopting the Diesel engine to their use—not singly but in large groups whose construction provides valuable work for engine building companies.

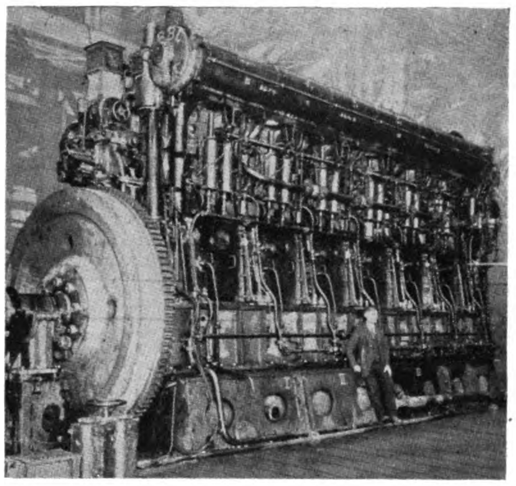
The days when one could describe one motorship of a fleet or the first motorship of a fleet as something remarkable are rapidly disappearing. It is becoming necessary to deal with whole fleets at once.

Of particular interest in this connection is the Hamburg-American Line and associated companies—the group generally known as the Hapag group. Its fleet—including that of the former Hugo Stinnes Lines—numbers no less than 18 motorships aggregating 97,000 gross tons. Among the 20 vessels of the Hapag now building, totalling about 150,000 gross tons, there are only two steamers, all the rest being motorships.

Motorships recently completed, completing and under construction include diversified types of drive. This would perhaps indicate that the company is not entirely decided as to which is the best type or make of engine for its purpose, but as will be seen upon further examination there are service groups, and each constructional or service group has, to a great extent, power and engine standardization. Gear drive, for example, characterizes ships of the South American service. It will also be used in two fine ships building for Hamburg-New York service. Double-acting Diesels of distinctive improved 2-cycle type characterize the fleet of four large ships now completing for the Pacific Coast service of the Hamburg-American Line.

These "Pacific Coasters" are in effect among the most important and up-to-date motorships under construction at the present time, because they have actually carried the "Pacific Coaster" idea a stage further than any existing ships yet built.

Most original vessels of this type were intended to carry a small quantity of general cargo outward from U. K.-Continent ports and to return with the grain and lumber of the Pacific northwest and the fruit and refrigerated produce of California, the ports of call being Vancouver, Seattle, Portland, San Francisco and the Panama Canal. Passengers were not at first considered as anything but a potential



One of four M.A.N. units of the geared motorship Monte Cervantes

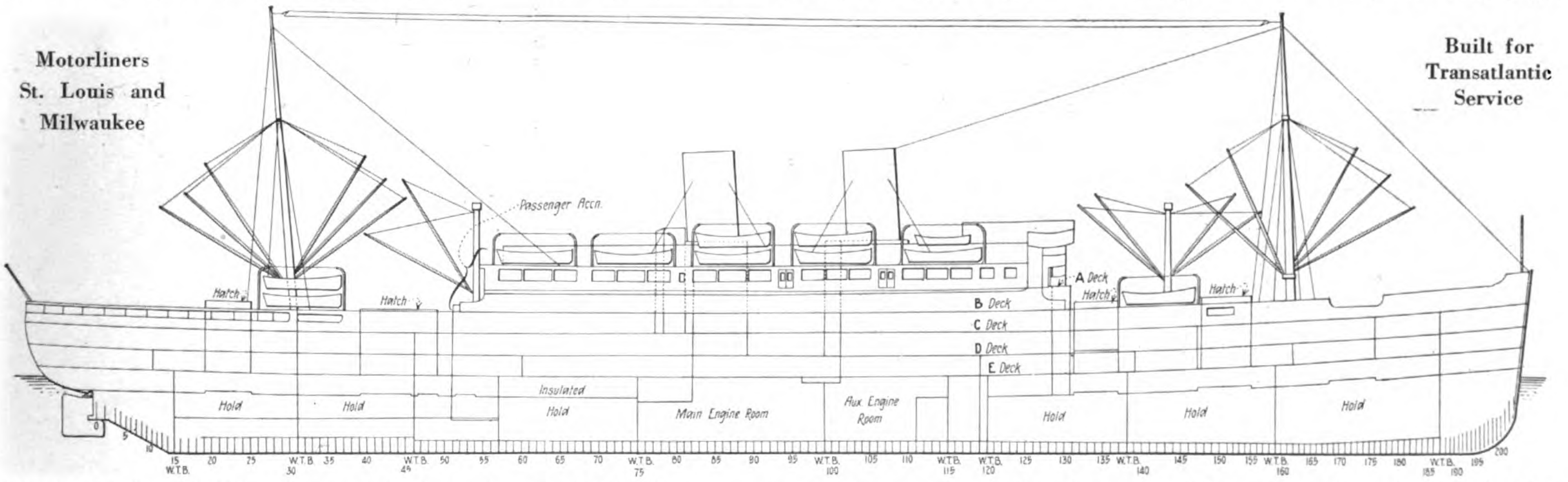
"make up" to fill a few empty cabins. It was not, in fact, until the advent of bigger and faster motorships with speeding up of service and general competition that passenger carrying began to assume any proportions. It has now reached a high state of perfection in these new German "Pacific Coasters," whose general arrangement—holds, decks and machinery space—is well shown herewith, and whose dimensions are indicated in the table attached.

The new motorships SAN FRANCISCO, LOS ANGELES, PORTLAND and SEATTLE have 12 outside 2-bed staterooms, dining saloon seating 30, ladies saloon with piano, smoking room and bath rooms, situated on the upper promenade deck. Third class has six outside 2-berth cabins and three 4-berth cabins with a dining saloon seating 24 and a smoking room, situated on the lower promenade deck. Each of these vessels is licensed to carry a maximum of 48 passengers.

These ships represent the first attempt on the part of "Pacific Coasters" to carry more than one class of passengers, and they will unquestionably introduce severe competition among lines running to this part of the world. If one can say that motorships are definitely replacing steamers on certain long haul trade routes, then here is a route from which the steamer is being rapidly eliminated.

Special interest centers around the machinery which will consist of a single 5 or 7 cylinder double-acting 2-cycle M. A. N. Diesel of 27½ in. cylinder diameter and 47¼ in. stroke developing 4200 hp. at 90 r.p.m. and 5400 hp. at 84 r.p.m. This, we may note incidentally, is approximately the same power as that developed by the twin screw 10,000 ton deadweight PACIFIC RELIANCE class owned by Furness Withy & Co. and recently placed in Pacific Coast service. These ships have, however, two 8-cylinder 4-cycle single-acting Diesels each, operating at 115 r.p.m.

These new Hapag motorships represent an important development in single screw motorship propulsion. Of equal importance, too, is a further group of Hapag motor freighters which will be single screw ships propelled by the much discussed A. E. G.-Hesselman airless-injection double-acting 2-cycle Diesel. Below is reproduced a sketch of one such engine taken from the paper which Dr. Sass read before the Institute of Marine Engineers (London) in November last. The novel and interesting features of this engine are already well known and have been widely discussed. For a 6-cylinder 6000 hp. engine operating at 120 r.p.m.—Dr. Sass says—the approximate weight is 440 tons, the weight per



Ms. St. Louis and Milwaukee will be the only geared Diesel passenger motorliners on transatlantic service. They are an important part of the Hapag building program

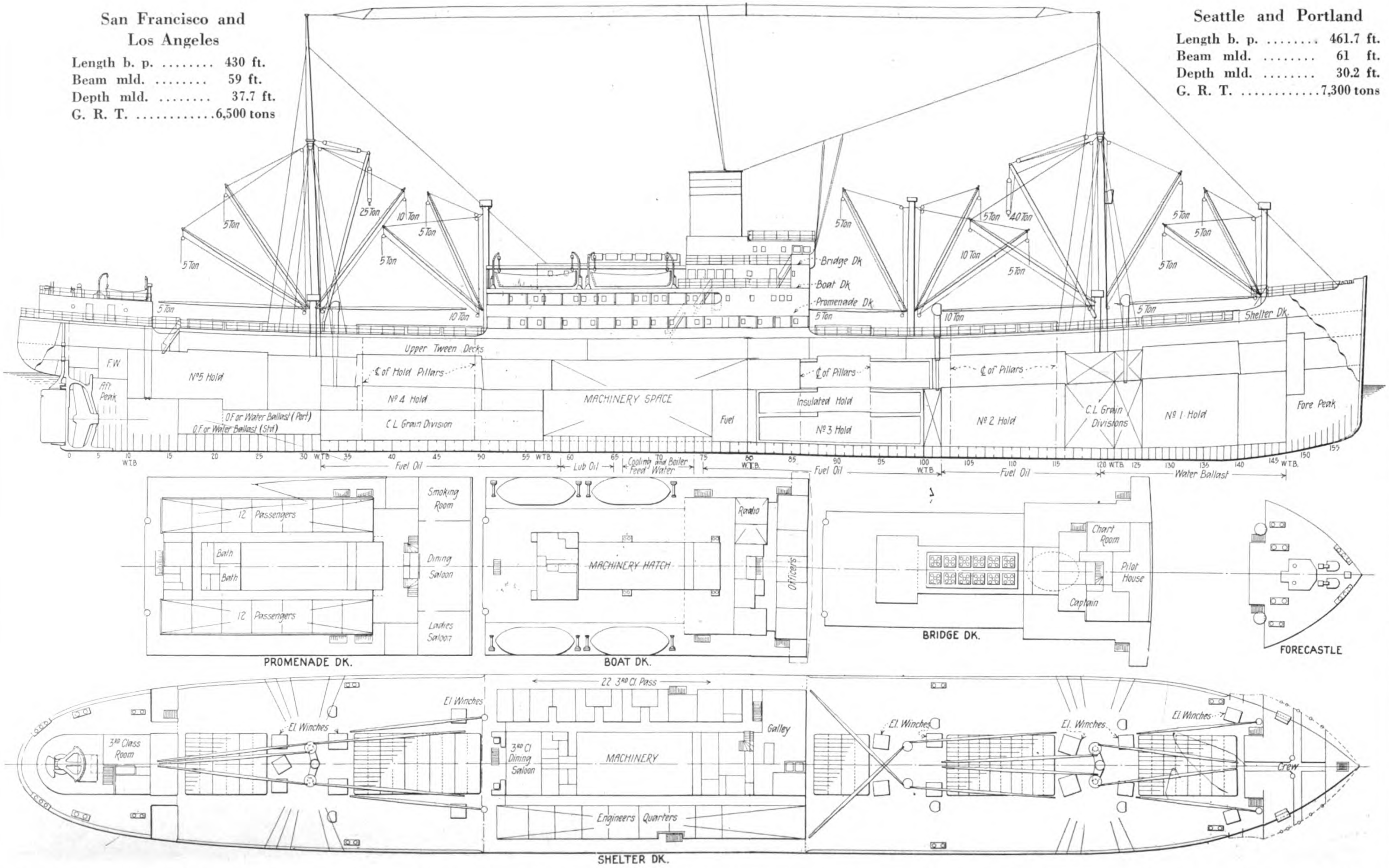
The Latest "Pacific Coasters"—Four Big Hapag Single Screw Motorliners of "San Francisco" Class

San Francisco and Los Angeles

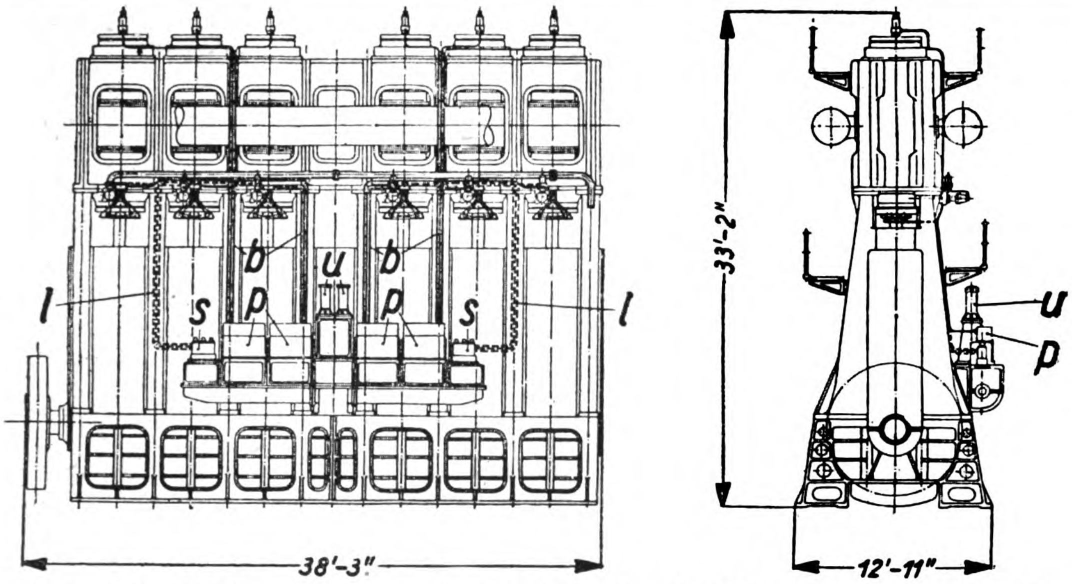
Length b. p.	430 ft.
Beam mld.	59 ft.
Depth mld.	37.7 ft.
G. R. T.	6,500 tons

Seattle and Portland

Length b. p.	461.7 ft.
Beam mld.	61 ft.
Depth mld.	30.2 ft.
G. R. T.	7,300 tons



*The four new ships built for the **Pacific Coast Service of the Hamburg American Line** are small fast single screw intermediate liners with excellent accommodations for cabin and third class*



A 6-cylinder 6000 hp. A. B. C.-Hesselman double acting Diesel for new Hapag construction

s.hp. being 162 lb. In the middle of the engine platform the reversing gear *u* is mounted. Right- and left-hand of the latter there are the fuel pumps *p* and the governing valves *s* for the starting air valves provided on the bottom cylinder side only. The fuel oil pipes, *b* and the governing air pipes *l*, are placed alongside the engine frames. Three engines of this type are completing in the workshops of the Allgemeine Electricitäts-Gesellschaft, of Berlin.

Before turning to consideration of the geared ships, we may mention that among the Hapag cargo liners now building is a 10,000 ton ship fitted with an 11-cylinder Sulzer Diesel developing 5100 b.hp. at 98 r.p.m. It would seem that opinion of the Hamburg-American engineers is very heavily on the side of the 2-cycle engine. This, indeed, is a feeling existing in the minds of nearly every one in the German shipping industry.

The new transatlantic liners ST. LOUIS and MILWAUKEE are twin screw ships of some 12,400 collective b.hp. each screw being driven by two double-acting 2-cycle M. A. N. Diesels of 3100 b.hp. apiece through mechanical gearing. Each engine is a 6-cylinder unit with 19 in. diameter and 26 in. stroke operating at 225 r.p.m. The propellers operate at 110 r.p.m.

Geared oil engine drive is no novelty as far as the Hamburg-American Line is concerned. Among their earliest units of this type were the HAVELLAND, commissioned in November, 1921, MUENSTERLAND, commissioned in January, 1922, and VOGTLAND, commissioned October, 1924. All these three twin-screw ships have a total dwt. capacity of 10,235 tons and a propeller power of 3300 s.hp.

The engines are standard M. A. N. full Diesel air injection submarine type Diesels. The piston diameter is 20.87 in. with 20.87 in. stroke. Each engine has ten working cylinders, designed for a maximum of 3000 b.hp. at 390 r.p.m. when operating in war ships, but cut down to a steady load of 1660 b.hp. at 230 r.p.m. in merchant ships The pitch diameter of the pinion is 31.5 in., of the gear 85 in., number of teeth 167 and 452 respectively, 47.2 in. face, 5.31 D.P. These drives were built by Blohm & Voss.

Large Gear Units

In November, 1924, the Blohm & Voss Co. completed another geared ship, the twin-screw ms. MONTE SARMIENTO, which was followed several months later by a sister ship ms. MONTE OLIVIA. In the propelling machinery of these two ships the principle of gearing a number of engine units is used. This was first realized in America by The Falk Corporation. They are at present actively engaged in geared Diesel production. The two ships mentioned above are combined passenger and freight carriers of 13,628 gross tons apiece with a length of 523.9 ft. Each of their twin propellers is driven by a pair of 6-cylinder Diesels of a combined output of 3500 b.hp., the total power of each ship being 7000 b.hp. when supercharged. The normal output is 6000 hp. Very heavy fly wheels have been fitted on the engines and brakes provided on them in order to permit quick stopping when maneuvering.

These ships have been built for emigrant trade between Hamburg and the River Plate and have recently been joined by a third similar ship the MONTE CERVANTES, in which supercharge has not been used. This ship is of 14,000 tons gross and has a service speed of about 14½ knots.

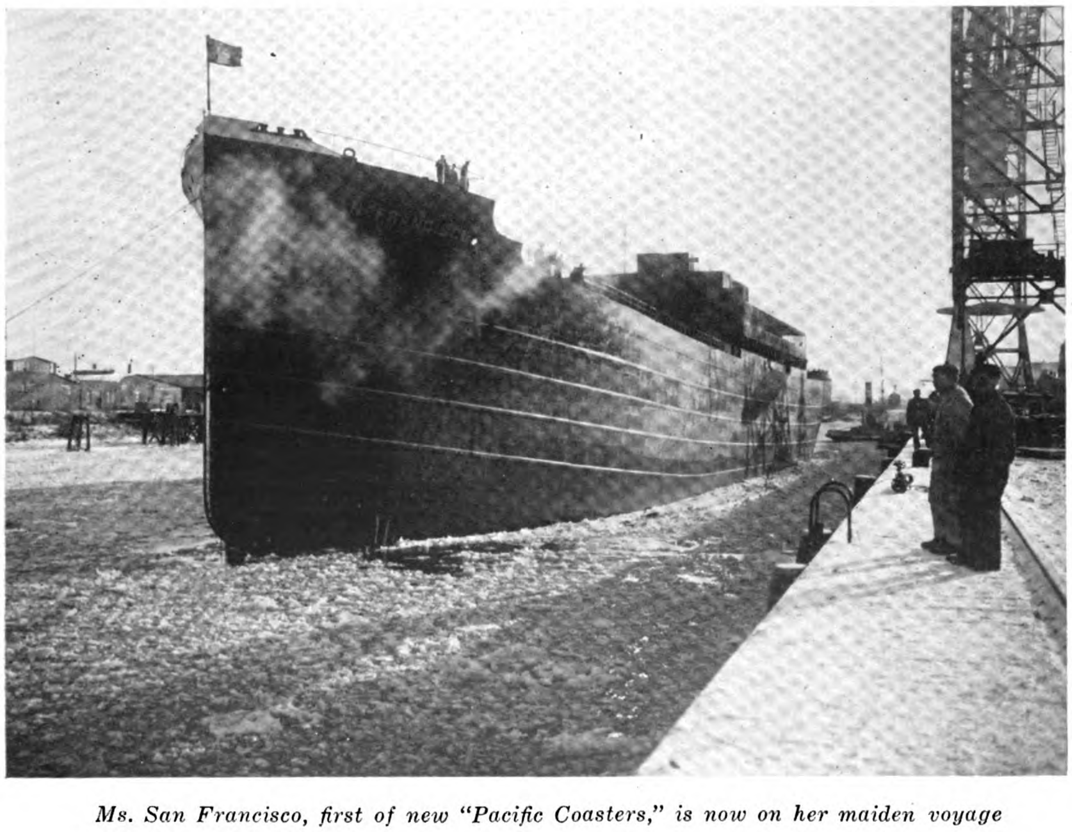
The geared machinery is naturally of high speed type and the machinery weight works out at the very low figure of 230 lb. per hp. This is one of the most important and frequently neglected features of geared oil engine machinery. It is a feature which builders of short run high speed ships would do well to remember.

The main propelling plant of this plant comprises four M. A. N. single-acting 4-cycle units, of normal crosshead design. They run at 210 r.p.m. and each pair drives its propeller at 77 r.p.m. Flexibility between the engine and the propeller shaft was originally tried out on the MONTE SARMIENTO and on her sister ship but it was abandoned and a direct geared drive provided in this ship.

Auxiliaries

Steam-driven deck machinery is provided, and a number of steam auxiliaries are used in the engine room. There are, however, four generating sets of about 1200 kw. total capacity. At sea steam can be raised by exhaust gas boilers. Fuel consumption per 24 hours is about 35 tons, and the fuel oil capacity in the double bottoms and tanks is 2600 tons. This is stated to be sufficient capacity for a round voyage to the River Plate.

One of the first single screw geared freighters of large size was the FRIESLAND, built by the Blohm & Voss Co., but in this ship the twin screw arrangement was abandoned and replaced by single screw propulsion. The propelling machinery consists of a pair of 10-cylinder engines of exactly the same type as that in the older ships, but these engines are geared to one propeller in exactly the same way as in the case of the MONTE SARMIENTO engines. The propelling power transmitted through



Ms. San Francisco, first of new "Pacific Coasters," is now on her maiden voyage

Principal Hapag Motorship Construction for North American Service*

Name of Motorship	Builder Delivery Date	Length	Dimensions Beam	Depth	Gross Register Tons	App. Service Speed	Total Power	Engine R.P.M.	Bore Ins.	Stroke Ins.	Cycls.
Pacific Coasters											
San Francisco	Deutsche Werft, Hamburg, Delivered	430 ft. 0 in.	59 ft. 0 in.	37 ft. 9 in	6,500	13 knots	4,200	90	27½	47½	5
Los Angeles	Deutsche Werft, Hamburg, Spring, 1928	430 ft. 0 in.	59 ft. 0 in.	37 ft. 9 in.	6,500	13 knots	4,200	90	27½	47½	5
Seattle	Deutsche Werft, Hamburg, Summer, 1928	461 ft. 9 in.	61 ft. 0 in.	30 ft. 2½ in.	7,300	14 knots	5,400	84	27½	47½	7
Portland	Bremer Vulkan, Vegesack, Summer, 1928	461 ft. 9 in.	61 ft. 0 in.	30 ft. 2½ in	7,300	14 knots	5,400	84	27½	47½	7
North Atlantic Ships											
St. Louis	Bremer Vulkan, Vegesack, Winter, 1928	541 ft. 4 in.	72 ft. 2 in.	45 ft. 3 in.	16,000	16 knots	6,400	225	19	26	6
Milwaukee	Blohm & Voss, Hamburg, Spring, 1929	541 ft. 4 in.	72 ft. 2 in.	45 ft. 3 in.	16,000	16 knots	6,400	225	19	26	6

* Table based on information supplied and checked by Hamburg American Line.

the low speed gear is 4000 b.hp. This ship was commissioned during 1926.

Another expression of the geared oil engine idea which has the same advantages as far as the Diesel is concerned is represented by the introduction of the hydraulic clutch invented by Dr. Foettinger. The first installation of this kind was made in the ms. VULCAN, commissioned in July, 1924. This was a 2000-dwt. ship having a length of 229.7 ft., a beam of 36 ft., and a load draft of 16.25 ft., and two 6-cylinder engines of 310 b.hp. each at 300 r.p.m., operating the propeller through the reduction gear at a speed of 85 r.p.m.

Ms. DUISBURG of 10,000 dwt. capac., commissioned in July, 1925, and her sister ship RENSBURG, are both equipped with a Foettinger geared drive The propelling machinery consists of a pair of 8-cylinder M. A. N. type engines. The total power developed is 4100 b.hp.

Ms. DUISBURG is now the HEIDELBURG running to the Pacific Coast in company with the smaller ms. ORSIRIS and the new "big four" of the LOS ANGELES class. She has a speed of 13 knots and makes the trip from Hamburg to Los Angeles in 33 days; to San Francisco in 35 days.

Sufficient has been said to indicate that one of the most important German shipping concerns—a concern which with the completion of the present motorship building programme will give to the Hapag a total tonnage of about 1,000,000—is very thoroughly convinced as to possibilities of the marine Diesel.

Modern ocean transportation is so highly competitive that it is not a question of national preference—or anything sentimental which gets trade. Rather is it solid service. In other words, the man who is there with the ship gets the cargoes provided that the ship is faster, and more up-to-date than any other ship. Hapag motorships are likely to play a very important part in ocean transportation in the future, because of this fact.

"Compromise" Legislation for U. S. Merchant Marine

VERY little of a helpful nature seems to be coming through from Washington which points to any definite action on the part of Congress regarding the U. S. merchant marine problem. Nor do we seem to be any nearer reaching a solution as to the future of the Shipping Board.

It is unfortunately true that the Board by its many apparently incongruous actions has severely alienated the sympathies of a great section of the shipping community. So much is this the case that the good work the Board has accomplished and is accomplishing passes unnoticed. The Jones act, in suggesting a continuation of Shipping Board operation has been bitterly attacked. No one really wants permanent continuance, but many people feel that the Board is serving a useful purpose until it has something good to hand over to private interests. Others feel that a compromise bill with the best features of all bills so far proposed will meet the case. It is thought that the House Committee on the Merchant Marine headed by Representative White, of Maine, will lose little time in drawing up a compromise shipping bill which, it is hoped, will meet with the approval of the House and Senate and make possible the establishment of an American merchant marine under private operation.

This measure is expected to be a composite of the Wood, White and Jones Bills, the feature of which would be the liberalization of the Shipping Board's construction loan fund whereby American shipowners can borrow money at a low rate of interest with which to build new tonnage in American yards; increased mail rates to a point commensurate with present day operating costs and the making of long term mail contracts with ship operators, and the continuance of those services deemed essential by the Shipping Board until such time as they can be sold to private interests.

No reference to marine insurance is expected to be contained, as it is feared that such action would result in extended hearings on that subject and would defeat any chance of early legislation which is solely needed by private American shipowners.

The compromise bill is expected to determine once and for all whether the American merchant marine is to be privately operated or be continued by the government. Representative White is said to be prepared to wage a vigorous campaign for the enactment of the compromise bill, which will make private operation possible. It is known that President Coolidge is in favor of the measure.

The recent action of the Senate in passing the Jones bill proved disappointing to the proponents of private operation, who see in the bill the perpetuation of the government in shipping. However, there is reason to believe that the Senate will be favorable to any plan that will guarantee the establishment of an adequate merchant marine. Opinion as to what is best for the future is sharply divided, which is not helpful for constructive work.

Hapag West Indies Motorships

The motorships ORINOCO and MAGDALENA, now building in Bremen and Danzig respectively for the Hamburg-American Line, will be placed in the West Indies Service of that Company in April of this year. The ships are alike in design and measurement, each being 426 ft. in length with a gross tonnage of 9,000, and accommodations for 140 first-class, 100 second-class and 100 third-class passengers. Two Diesel engines developing collectively 13,000 hp. will be fitted on each vessel, and a sea speed of 15 knots is expected.

Motorliner Kungsholm Launched

The motorliner KUNGSHOLM, now building for the Swedish American Line's service between New York and Gothenburg, was launched March 17 at the shipyards of Blohm & Voss in Hamburg, in the presence of officials of the line and many dignitaries. The christening was performed by Mrs. Axel Carlander, wife of the president of the Swedish American Line. Ms. KUNGSHOLM will make her maiden voyage from Gothenburg on November 24, and from New York on December 8.

While somewhat larger than her sistership, Ms. GRIPSHOLM, which has the distinction of being the first transatlantic passenger motorliner, the KUNGSHOLM will have the same general features. She will be powered by two double-acting, 8-cylinder Diesel engines developing 24,000 hp. Bids for the next batch of Shipping Board Diesel Conversions, for which engines are now building, will be asked on May 1. Either 2, 4, 6, or 8 ships may be offered.

Double-Acting Diesel Development

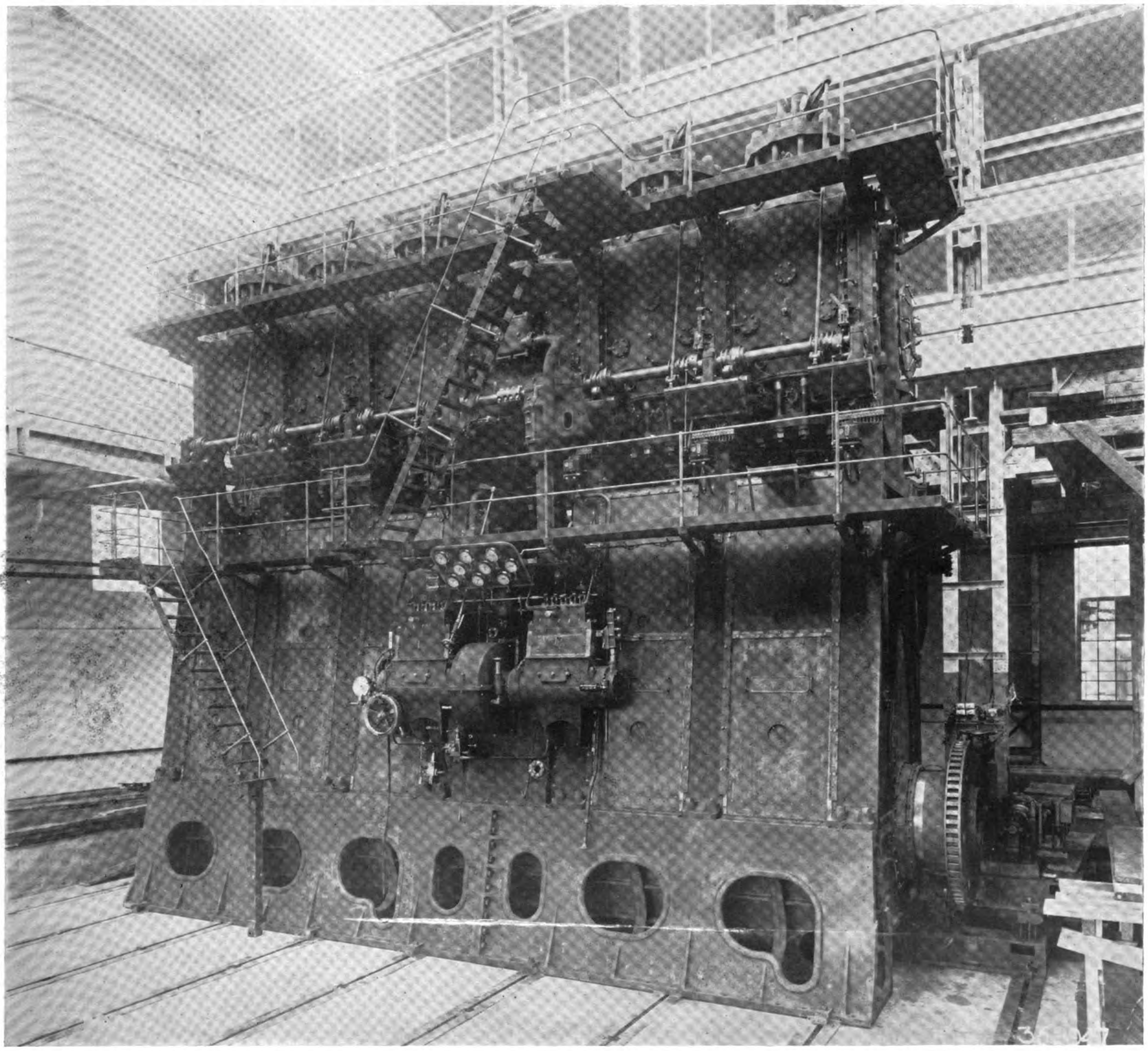
Simplified Construction Developed by M.A.N. for Double-acting 2-Cycle Diesels Includes New Cylinder Block Design

THE M.A.N. patent port scavenging system introduced a few years ago gave such satisfactory results that a standard sibe engine of 27½ in. cylinder diamater with 47½ in. stroke was developed in 4 and 6 cylinder units. These engines were built simultaneously by M.A.N. and their licensees. Later the Blohm and Voss Co., under license from M.A.N., built a 15,000 hp. stationary engine of nine cylinders with a cylinder diameter of 34 in. and a stroke of 60 in. for the Hamburg Electric Company. This is at present the largest Diesel Engine in the World and, although its design was only based on laboratory tests, the engine proved entirely satisfactory and is serving the City of Hamburg daily, taking care of peak load conditions.

One of the latest motorships placed in commission is the motorliner AUGUSTUS, which has four standard 6 cylinder sets, with a total horsepower for the main engines of 28,000. This ship has successfully had its trial trip and also completed several voyages to Buenos Aires, with excellent results. Recently, M.A.N. has further developed its double-acting engine, in the original standard size, resulting in a simplified construction. They have also developed a standard size in smaller powers with higher revolutions.

As far, then, as marine work is concerned, it can readily be seen that the engines can be grouped as (1) slow running engines, and (2) fast running engines. The engines in the slow running group are used for single screw ships. The reason for this is that the double-acting Diesel engines of the M.A.N. type have proved themselves absolutely reliable. Such engines are at the present time under construction also in America, England, Holland, Italy and Russia.

The engines in the second group are principally intended for large and small passenger ships. Such ships are the ST. LOUIS and the MILWAUKEE which have a speed of 17 knots and are at the present time under con-



A 6-cylinder unit of the newest type M. A. N. double-acting 2-cycle Diesel showing arrangement of controls and modified cylinder design

struction at the Blohm and Voss and the Weser Yards. The engines are so arranged that there are two engines for each propeller, the ships being twin screw ships.

Other licensees have, at the present time, smaller passenger ships under construction which will use similar but smaller engines. The advantage of the high speed engine is that it decreases the weight and the space in the engine room and, with the fast running ships, it can be directly connected to the propeller with the propeller so dimensioned that a high overall efficiency can be obtained.

Recent experiments with the M.A.N. double-acting engine have proven that efficient scavenging can be obtained in the double-acting, 2-cycle engine of high speed, and this, therefore, makes it possible to obtain large power in small cylinders and resulting in a low weight and initial cost of the engine and further, low weight and low cost for the generator.

In large high speed M.A.N. Diesels of stationary type unless solid injection has been used. The use of solid injection results in the elimination of the compressor, decreasing the weight of the engine and increasing the efficiency. These advantages in the larger units result in marked savings through lower initial cost and lower fuel consumption. Although great strides have been made in the development of the double-acting, 2-cycle engine during the past years, it is safe to state that the limits have not been reached for the maximum horsepower installation. It is also possible to build special engines with less weight and at a lower cost by special materials and designs.

The modified construction, under which marine engines are now being built, is concerned with the cylinder block design. Each cylinder is made individually, bolted together and also bolted to the top of the housings. The lower part of the housing is attached to the bedplate. The tie rods on each side of the main bearings

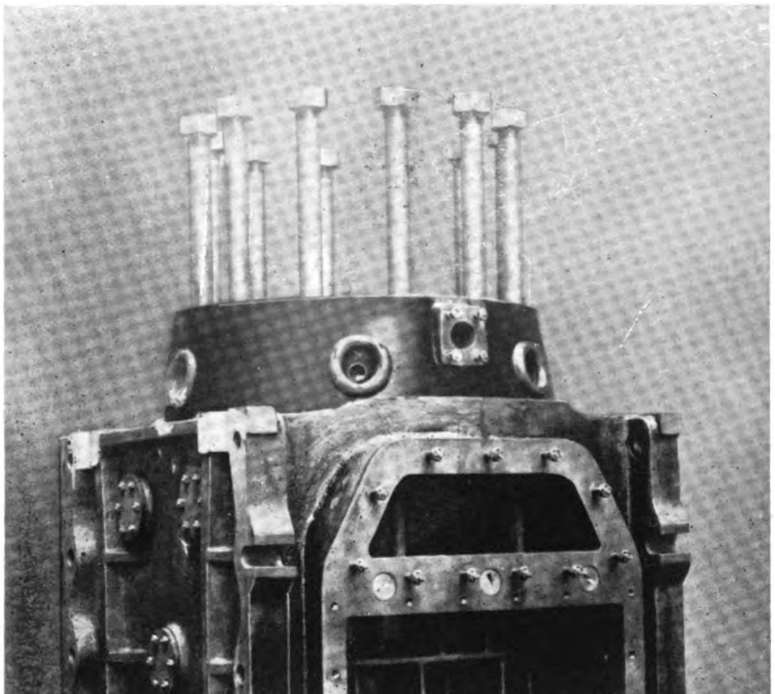
Lower cylinder cover has four horizontal valves

hold the cylinder, housing, and bedplate together and as the bolts are set up with an initial tension, the cast iron parts are entirely relieved of the combustion load. The crosshead guide is located inside the crank case and bolted to the housing forming a tie lengthwise to the engine. When an air compressor is used, it is usually located in the middle of the engine and set into a tie piece which is bolted to the cylinders. The main cylinder is especially designed for the best distribution of the load. The liner is set into the cylinder barrel and is split below the port so that the upper part of the liner has all of the ports whereas the lower liner is a straight liner. The lower liner is of short length so that it can be removed in the space between the cylinder and the top of the crank case.

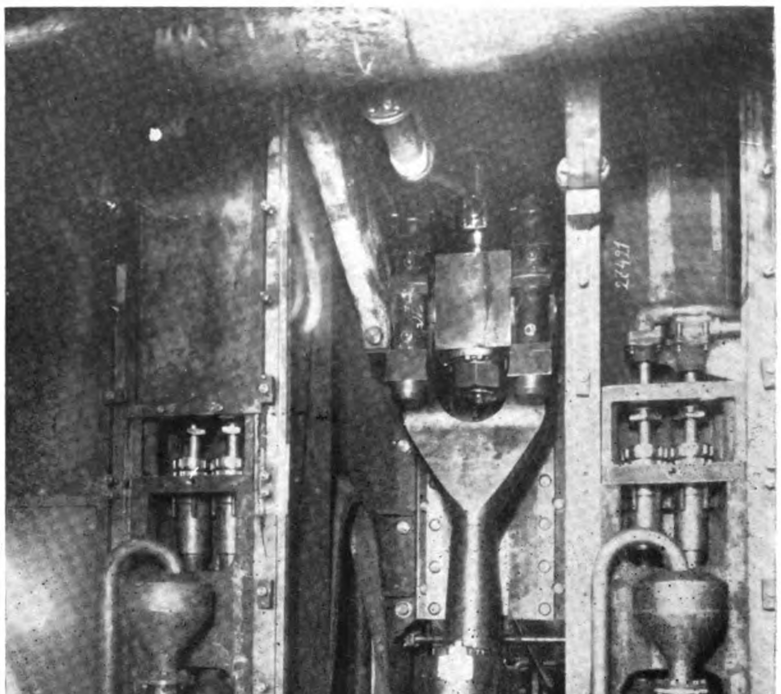
The cylinder heads are made in two parts. The cast iron cover holds the lower part, which is made of electric steel, against the liner. Cooling water is forced through passages so as to obtain the most efficient cooling both for the liner as well as the cylinder heads and provisions are made for contraction and expansion on the liners and cylinder heads.

The joint between the cylinder head and the liner is so arranged that the piston ring travels to the end of the liner, which gives the advantage of a short liner. The valves in the cylinder head are set horizontally in the steel part of the cylinder head.

The lower cylinder head has two fuel valves, one starting valve and one safety valve, all arranged horizontally (with the airless injection engine, the fuel valves are arranged around the piston rod with a spray directed against the outer wall). The upper cylinder head has one centrally located fuel valve and one horizontally arranged safety valve, this arrangement making possible the simplest construction for the drives. The camshaft is lo-



Each cylinder structure is made separately and the cylinder units are bolted together

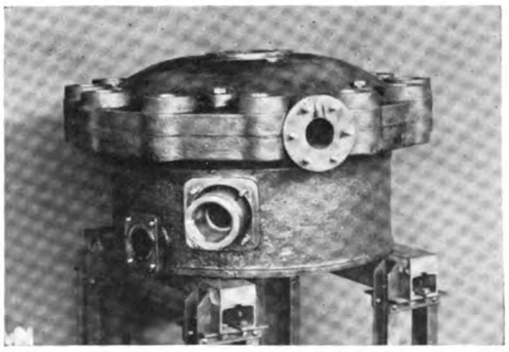


Crosshead guide is located inside the crankcase and bolted to the housing

cated at the upper end of the housing on the operating side and is driven from the main shaft through straight and bevel gears.

Marine engines have a special pneumatic oil cylinder which moves the camshaft longitudinally and, with a double set of cams, places either the "ahead" or "astern" cams in contact with the rollers for driving the valves, and by a special arrangement of cams, the movement of the camshaft can be accomplished without lifting the rollers from the cams. The fuel pumps are arranged on the operating stand and are driven from the vertical drive. Fuel plungers are built into two blocks—one for the upper end of the cylinder and one for the lower end of the cylinder. The governor is of the inertia type, arranged between the fuel pump housings and driven from the same shaft as the fuel plungers, operating gear being located on the fuel pump brackets. Entire control of the engine is carried out by turning one hand wheel. For marine engines a separate change valve places the engine either in the "ahead" or "astern" position. This change valve is also connected with the engine room telegraph, which prevents a wrong maneuver of the engine. This is a valuable point.

The piston cooling system is separate from the cylinder cooling and the water is forced into the pistons through telescopic piping driven from the main crosshead. The arms for carrying these rods are on the side of the



Top cylinder cover has two fuel valves

crosshead and brought into the housings. The stuffing boxes for the telescopic pipes are arranged in the housings and open to the outside. This arrangement prevents oil from being thrown from the crank case on the piston cooling pipes, eliminating a mixture of the cooling water with the oil. It has also, the further advantage of free access to connecting rods and crossheads for inspection and repair.

Connecting rod, piston, piston rod, and piston rod stuffing box correspond in design to previous M.A.N. engines.

In order to compete in the commercial field, even with a highly economical unit like the Diesel engine, initial cost is a vital consideration. By concentrating large powers in one cylinder, small weights are obtained. For instance, the double-acting, 2-cycle engine of normal type 7000 hp. including everything weighs only 112 lb. per horsepower (eliminating flywheel and air bottles). For airless injection stationary engines of 11,700 hp. the weight is only 55 lb. per horsepower. The increase in revolutions has opened a field for these engines in stationary plant.

The M.A.N. engines as described and illustrated in this article are being built in this country by the Hooven, Owens, Rentschler Company of Hamilton, Ohio, and by the New London Ship & Engine Co., builders of the Nelseco Diesel.

Motorships in Service with M.A.N. Type Double-acting Diesels

Name	Owner	Builder	No. of Cyls.	Power	RPM	Cyl. Dia.	Stroke	Engine Builder
Magdeburg 9400 Tons	Hamburg Am. Line	Blohm & Voss	6	4000	75	27½	47¼	Blohm & Voss
Ramses 11,660 Tons	Hamburg Am Line	Flensburger Shipyard	6	4400	84	27½	47¼	M.A.N.
Seminole 9500 Tons	U. S. Shipping Board	Tietjen & Lang (Conversion)	4	3680	106	27½	47¼	H.O.R. Company, Hamilton, Ohio
Wilscox 9500 Tons	U. S. Shipping Board	Fore River Shipyard (Conversion)	4	3680	106	27½	47¼	New London Ship & Eng. Company
Augustus 31,000 Tons	Navigazione Generale, Italiana, Genova	Ansaldo, S. A., Genova	6 6 6 6	7000 7000 7000 7000	125	27½	47¼	Savoia & M.A.N.
Altmark 8000 Tons	Hamburg Am. Line	Blohm & Voss (Conversion)	3	2000	75	27½	47¼	Blohm & Voss
Braunfels 11,000 Tons	Hansa Line, Bremen	Weser Yard	6	4000	76	27½	47¼	Weser & M.A.N.
Rotenfels 11,000 Tons	Hansa Line, Bremen	Weser Yard	6	4000	76	27½	47¼	Weser & M.A.N.
Kota Inten 9300 Tons	Rotterdam, Lloyd	Fijenoord	7	5200	86	27½	47¼	Fijenoord & M.A.N.
Rheinland 10,000 Tons	Hamburg Am Line	Deutsche Werft	6	4500	85	27½	47¼	M.A.N.
Submarine Motorship	British Admiralty	Vickers, Ltd. (Est. H. P.)	4 4	3500 3500	100	27½	47½	Vickers, Ltd.

Total Horsepower 74,760

Motorships Building with New Type M.A.N. Double-acting Diesels

Ship	Owner	Builder	No. of Cyls.	Horse Power	RPM	Cyl. Dia.	Stroke	Engine Builder
Builders No. 102	Hamburg Am. Line	Deutsche Werft	5	4200	90	27½	47¼	M.A.N.
Builders No. 103	Hamburg Am. Line	Deutsche Werft	5	4200	90	27½	47¼	M.A.N.
Builders No. 104	Hamburg Am. Line	Deutsche Werft	7	5400	84	27½	47¼	M.A.N.
Hochland 9300 Tons	Hamburg Am. Line	Bremer Vulcan	7	5400	84	27½	47¼	Bremer Vulcan
Trave 11,000 Tons	German Lloyd	Stettiner, Vulcan	6	4600	86	27½	47¼	M.A.N.
Kota Gede 9300 Tons	Rotterdam Lloyd	Fijenoord	7	5200	86	27½	47¼	Fijenoord-M.A.N.
Builders No. 373	Hamburg Am. Line	Flensburger Shipyard	6	5000	90	27½	47¼	M.A.N.
St. Louis 10,000 Tons	Hamburg Am. Line	Bremer Vulcan	6 6 6 6	3100 3100 3100 3100	225	19	26	Bremer Vulcan-M.A.N.
Milwaukee 10,000 Tons	Hamburg Am. Line	Blohm & Voss	6 6 6 6	3100 3100 3100 3100	220	19¾	25¼	Blohm & Voss
Builders No. 272 6000 Tons	Hamburg Am. Line	H. Koch, A. G. Lubeck	6	3500	120	23½	36	M.A.N.
Builders No. 273 6000 Tons	Hamburg Am. Line	H. Koch, A. G. Lubeck	6	3500	120	23½	36	M.A.N.
Building 3900 Tons	Italian Trans-Atlantic Co., Rome	Ansaldo, S. A., Genova	3 3	1500 1500	118	23½	36	Savoia
Building 3900 Tons	Italian Trans-Atlantic Co., Rome	Ansaldo, S. A., Genova	3 3	1500 1500	118	23½	36	Savoia
Builders No. 873	Marseillaise Nav. Co.	Weser Werk	6 6	1650 1650	165	17¼	24½	Weser
Freighter 9500 Tons	U. S. Shipping Board	Conversion	4	4000	110	27½	47¼	H.O.R. Co., Hamilton, Ohio
Freighter 9500 Tons	U. S. Shipping Board	Conversion	4	4000	110	27½	47¼	H.O.R. Co., Hamilton, Ohio
Building	Hamburg Am. Line	Bremer Vulcan	6 6	4100 4100	138	23½	36	Bremer Vulcan

Total Horsepower—91,300

The Editorial Viewpoint

Emergency Auxiliary Generators

A CURRENT ACCOUNT of the mishaps to the Eastern Steamship Co.'s fast coastwise steamer ROBERT E. LEE which went ashore recently near Cape Cod Canal mentions that it was necessary to use batteries to operate the radio, all regular power being cut off presumably owing to the flooding of the boiler room—that vulnerable spot on all steamers which has no corresponding position in a motorship.

The account states, even the batteries were used up. There is, one feels, much to be learned from this lesson. In the first place the advantage of batteries on shipboard for standby purposes is clearly established. In the second place the advantages, amounting to a definite necessity, of fitting an auxiliary Diesel generator-battery set on all passenger ships—high up in the superstructure—are proven very definitely.

A ship's batteries run down after continual use—then start up your generator and charge them again. At the same time your Diesel gives you light for the passenger decks, thereby avoiding panic. A Diesel is so much more flexible than a steam plant. It would be practically impossible to pipe steam up to a top deck to a small turbo generator set there—apart from the fact that the boiler, in case of emergency, would be out of commission and therefore the generator set also.

The small Diesel generator set, and there are numbers on the market, is entirely self contained. Its worth has been proved again and again in emergency. The big Matson liner MALOLO found her auxiliary set of great use after her collision last year. Such sets, which should be fitted on all ships over about 10,000 tons carrying passengers, occupy very little space. A short run once every day ensures that they are kept in a state of maximum efficiency.

Italy's Small Fast Motorships

EACH MONTH PROVIDES further evidence of the increasing range of types of vessels equipped for motor propulsion. The present year commenced with booked orders in Europe, alone, representing in the neighborhood of 100,000 gross tons more of this motorshipping than all other types combined. It is particularly gratifying to note that so much new tonnage is of the fast short sea type, exemplified by those recently ordered for Liverpool-Belfast service. A large proportion of new Italian motorships will, undoubtedly, take their place in the various Mediterranean services, although a considerable number will be utilized upon increasing the Atlantic services or replacing steamers.

As a matter of fact Italy, which in regard to general shipbuilding had shown a decrease of over 25,000 tons for the September quarter of last year, but again marked an upward trend in the number of placed orders for the last quarter, is likely to maintain a lead in regard to motorship construction. Among the more prominent builders, the Società Anonima Ansaldo, which have a capital of 200,000,000 lire and shipyards at Genoa, has under prepartion the construction of three additional motorvessels intended exclusively for Mediterranean service. These vessels are being built for the Civitavecchia-Sardinia subsidized line, and the following are the chief dimensions:—Length, 95.21 metres; breadth, 13.30 metres; draught, 4.38 metres; displacement, 3,900 tons; gross tonnage, 3,700; d.w. 1050, and i.h.p. 3700; speed, 15.6 knots.

The first of these motorships will be fitted with two Tosi engines, and the others will have two M.A.N. motors, constructed by the firm of Franco Tosi.

At present there are fourteen passenger vessels fitted with Tosi engines in course of construction, the individual tonnage varying between 2300 and 5400, and the number of engines, to develop a total power of between 1800 and 7400 b.h.p., varying between one and two per ship.

A Bunkering Record

A CORRESPONDENT IN a letter to our contemporary *Fairplay* cites as "a very good performance" the fact that his coal burning freighter bunkered 2153 tons of coal at a South Wales coaling port between the hours of 11 p.m. on a certain Thursday and 5 a.m. on the following Saturday morning. The performance is considered as "very good" by virtue of the fact that the vessel's bunker spaces have both 'tween and shelter decks.

The average rate of loading, which as a matter of fact is a highly creditable performance, on the figures given works out at about 71.7 tons per hour. Nowhere in the world, of course, do loading rates approach those of the Great Lakes where (cargo) coal has been loaded at a rate of 1299 tons per hour.

The point to be made, however, is the relative slowness and unhandiness with which coal as a fuel has to be handled. Contrast 30 hours alongside the coal tips—with full cargo on board and money being lost on it—with the comparatively infinitesimal time that oil bunkering takes. Even pulverized coal—whatever its reduced consumption at sea—has to be loaded in the same way as ordinary coal. Many coal burning ships of course are badly designed from the point of view of bunkers, and little or no attempt has been made to produce maximum efficiency from the fuel handling point of view. It is conceivable that increasing competition from the motorship on all routes will convert the more conservative designers of steamers to a realization of the fact that it is only the most modern design of ship which can hope to capture rates at the present day.

The motorship is at an even greater advantage where quick turn-around is concerned. Electric winches give rapid cargo handling facilities. The smaller amount of fuel required reduces bunkering delays to a minimum.

South America Trade Developments

THE FAST MOTORSHIP building program of Garcia & Diaz, New York, which has attracted so much attention of the shipping world, is nearing completion, and marks that company's entry into the passenger carrying field as well as into the fast freighter field. Two of their new ships will have a speed of 18 knots and luxurious accommodations for tourists. For the time being Garcia & Diaz will have some of the fastest freighters and passenger lines trading between New York and South America (East Coast), but such is the fierce light of modern competition that their ships will be sharing speed honors with new Furness-Withy ships within the near future. There is every indication that the New York-S. America trade will shortly develop in speed and efficiency ships very closely comparable with the new big "Pacific Coasters." One of the new Garcia & Diaz motorliners, the SUD AMERICANA, was launched on February 18, and the other, the SUD EXPRESSO, will go down the ways early in April. Following trials, they are expected to sail from New York for South America in July and August. The vessels are of 12,000 tons each and will be driven by twin screws.

The other three motorships of the new fleet, the SUD ATLANTICO, SUD PACIFICO and SUD AFRICANO, are twin screw cargo vessels of 10,000 tons and will have a sea speed of between 13 and 14 knots. MS. SUD ATLANTICO has already been launched, while the SUD PACIFICO will be completed for launching April 1 to be followed by the SUD AFRICANO in August. All five of this fleet will be in operation late this summer.

Gracia & Diaz will inaugurate the first direct motorship service between Canada and the East Coast of South America by transferring their present fleet of five cargo motorships to this run. MS. SEGUNDO is scheduled to sail from Montreal on May 26, to be followed by MS. TERCERO on June 16. The other three vessels will be added so as to offer a monthly service, making the run to the River Plate in 26 days.

Here is another very definite effect of motorshipping in relation to the trade routes of the world.

Powering Fast Small Passenger Ships

BOTH BURMEISTER & WAIN and Harland & Wolff have now placed airless injection Diesel engines on the market. Harland & Wolff's first installation of this type will be the two 10-cylinder engines of 3000 s.hp. at 160 r.p.m. passenger ships to be run between Liverpool and Belfast referred to in our March issue, while the

Burmeister & Wain airless-injection engines will be two of 3300 s.hp. at 195 r.p.m. to be installed in a passenger ship running between Harwich and Esbjerg.

Both of these companies have had tremendous experience in marine Diesel construction and Burmeister and Wain were responsible actually for powering the first fast short run passenger vessel—the PARKESTON, now running regularly in the North Sea.

It is somewhat significant, therefore, that developments along the line of airless injection should come at a time like the present when such interest is being shown in fast relatively high speed passenger ships for short runs. Weight of engines and the space taken up for the required power compared with the space available has often been advanced as a disadvantage for Diesel powering of such ships. There may have been something to be said for this criticism a few years ago, but matters are proceeding very rapidly along the lines of high speed light weight Diesel development, and such engines in conjunction with gearing present a layout well worth investigation.

The Beardmore Company in Scotland has already prepared a geared high speed, light weight Diesel layout in which two "V" type 18-cylinder (12 in. x 12 in.) Diesel drive a common shaft through gearing and develop 4500 hp. in very small space.

The Falk Company in Milwaukee, Wisc., are keenly interested in similar developments and are following any possible contracts for fast coastwise ships.

The engines of these new fast Liverpool-Belfast ships are of direct drive type, but the ships themselves are somewhat larger than the fastest so-called cross channel ships plying between Great Britain and the Northern European continent.

Airless injection is conceivably a very important development on all ships of this type. Provided a perfect system can be devised, it reduces the space taken up by the prime movers and permits of a greater developed output per engine.

Motorship Progress

SOME PERTINENT FIGURES from a recent report issued by the U. S. Department of Commerce at Washington reflect very succinctly the trend in modern shipbuilding towards the motorship.

Another feature in the current shipbuilding returns—it states —worthy of special note is the increasing construction of motor-vessels. Not only has the tonnage of these vessels increased; it even has exceeded that of steam vessels by over 100,000 gross tons to 1,610,000 gross tons under construction on December 31, 1927. Coincident with this trend, there has been an extension in the building of tankers. There were under construction 745,000 gross tons at the end of 1927—436,000 tons more than at the corresponding time in 1925.

It would seem that the majority of progressive shipping men today are convinced that the Diesel driven vessel is the most economical to own and operate, besides providing a host of advantages that the steamship cannot possibly hope to attain due to the inherent characteristics of its propelling machinery.

With the same reliability and speed assured, people will naturally choose to travel via the cinder-and-dirt-free motorliner whenever possible. All other things being equal, manufacturers will ship their products in vessels offering the lowest freight rates; and a modern well run motorship can operate at a profit at rates which would mean a loss to the steamship besides giving a cleaner better service.

With facts such as these at hand the ship owner, operator or builder cannot afford to disregard motorships and motorshipping.

Diesels Power One of the Largest Dredges in the World

The Pipe Line Dredge New Jersey Operating on the Great Lakes

ONE of the highest expressions of Diesel powering for dredge work is seen in the big NEW JERSEY completed last year for the Great Lakes Dredge & Dock Co., Chicago, by the Manitowoc Sb. Co., Manitowoc, Wis. The Bucyrus Co., South Milwaukee, supplied the actual dredge machinery but the prime movers actuating the dredge machinery were built and supplied for installation in the ship by the Busch Sulzer Co., St. Louis, Mo.

The vessel has a well modeled hull and two strong fore and aft truss girders extending to the height of the house top and merging forward into the A-frame for the ladder hoist forward and tied aft with the two spud masts.

She is powered by four 1150 b.hp. Busch Sulzer Diesels which operate normally at 180 r.p.m. and are direct coupled to General Electric generators. These generator sets supply current for the whole of the power on the dredge and also drive the main dredge pump and booster pump. The suction arm is fitted with a powerful cutter head. The vessel has a sturdy workmanlike appearance.

Two Most Powerful Diesel-Electric Tugs

Panama Canal Builds Two 750 s.hp. Vessels for Heavy Duty Work with Electric Control and Propulsion

By Lieut. W. McL. Hague (C.C.) U. S. N.*

THE Diesel-Electric tugs TRINIDAD and CHAGRES are two of the most powerful and up-to-date tugs in the world. They are among the most powerful and, by virtue of their electric, propulsion among the most important. Towboat owners all over the world will do well to study their design and operation. They were built for the Panama Canal by the Mechanical Division of the Canal. Launched in May 1927, and they were completed in January 1928, the CHAGRES being turned over to the Dredging Division and the TRINIDAD to the Marine Division of the Panama Canal. Except for slight differences in equipment and arrangement the tugs are exactly alike.

Primary power is derived from two Ingersoll-Rand 6-cylinder Diesels of 480 hp. normal output at 257 r.p.m. The Diesel engines are direct connected each to a 330 kw. 250-volt generator and a 50 kw. 250-volt exciter. The main driving motor is of the double unit type mounted on the single propeller shaft and has a normal rating of 750 s.hp., but is capable of delivering continuously on overload 900 s.hp., at 1220/1450 amperes and 500-volts. The operating speed range of the main motor and propeller at full power is 115/150 r.p.m. The main propelling electrical machinery was supplied by the General Electric Company. The thrust of the screw is taken by a thrust bearing with a rating of 40,000 lb.

The main generators being directly connected to the Diesel engines are always turned at approximately 257 R.P.M. and on propulsion are in series with the two units of the driving motors. Speed variation is by the Ward-Leonard system of control. There are three control stations: the main switchboard in the machinery spaces, an after control station on the deck house and a control station in the pilot house. The pilot house and after station control is effected through standard Cory indicator pedestals operating a rheostat mounted under the pilot house false deck, the Cory indicators being mechanically connected. There is one pedestal at the after control station and one on each side of the pilot house. These pedestals are of the single handle type, the stop position being in the middle of the arc, full speed ahead position, 90 deg. forward and a full speed astern position 90 deg. aft. There are 25 speeds ahead and 25 speeds astern. Control of the tugs is much more natural and simple than the control of an automobile.

The steering gear is of the electro-hydraulic type built by the American Engineering Company, the 7½ kilowatt motors having been furnished by the General Electric Company. At full speed, approximately 13 knots, the steering gear is capable of putting the rudder from hard-over to hard-over in less than 11 seconds. The two usual steering stations provided are in the pilot house and at the after control station, but the tugs can also be steered at the steering gear which is located in the fan tail. No hand steering is provided, but the electro-hydraulic steering gear is duplicated throughout. Starting the steering gear motors is accomplished by remote control at the main switchboard. By making the stern frame a skeleton casting, as can be seen on the inboard profile, the turning circle of these tugs has been made very small, not exceeding 500 ft.

The two fuel oil tanks have a capacity of 108 tons of Diesel oil which gives the tugs a range of approximately 25 days at sea and a cruising radius of approximately 7000 miles under full power. The lubricating oil capacity in tanks and engines is 450 gal. A De Laval oil purifier with necessary tank accessories is installed in the engine room and it is believed that the lubricating oil carried will outlast the fuel.

The tugs can be used for fire fighting, being equipped with a 1000 gal. per min. 100 lb. Frederick Iron & Steel Company centrifugal pump driven by a 100/115 hp. General Electric motor. A fire monitor is mounted on top of the pilot house on the CHAGRES and on a platform forward of the foremast on the TRINIDAD and in addition there are two hose connections mounted on each side of the deck houses.

There are two 250 gal. per min. rotary Worthington manufacture bilge and circulating pumps either of which is capable of circulating both main engines. The sanitary pump is a 50 gal. per min. Frederick Iron & Steel Company centrifugal pump and is capable of furnishing emergency circulation to the main engines. Other auxiliary pumps are a fuel oil transfer pump and a fresh water transfer pump. The fresh water carrying capacity of each tug is 85 tons.

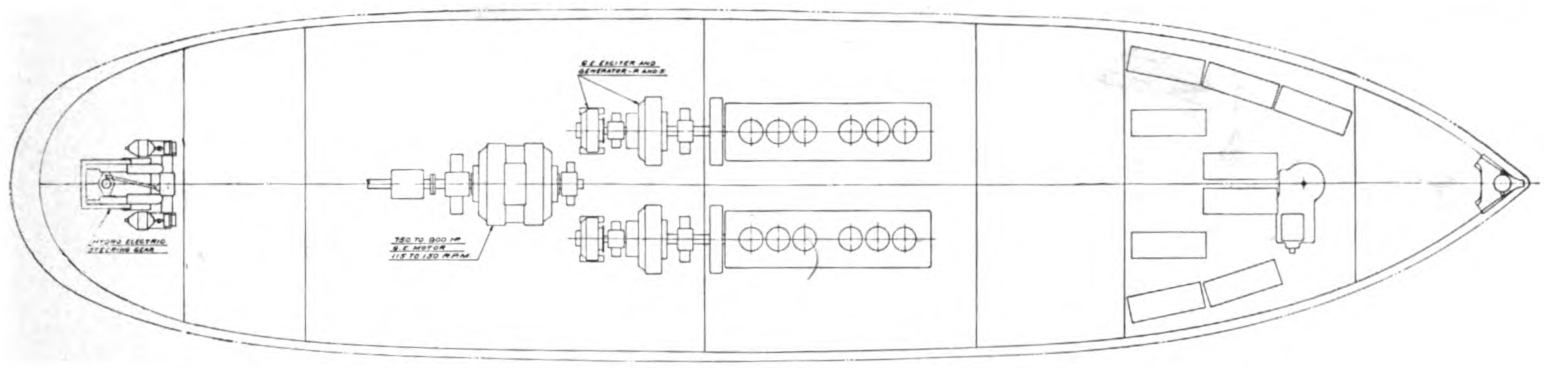
Each boat is provided with a Cummins Diesel auxiliary engine direct connected to a 12 kw. 220-volt generator and clutch connected to a two-stage 250-lb. Ingersoll-Rand air compressor. This air compressor is used only for pumping up three 5 cu. ft. air bottles for starting and galley air, the pressure of these bottles being normally maintained, when the main engines are running, by an automatic General Electric-Ingersoll-Rand combination motor driven two-stage air compressor.

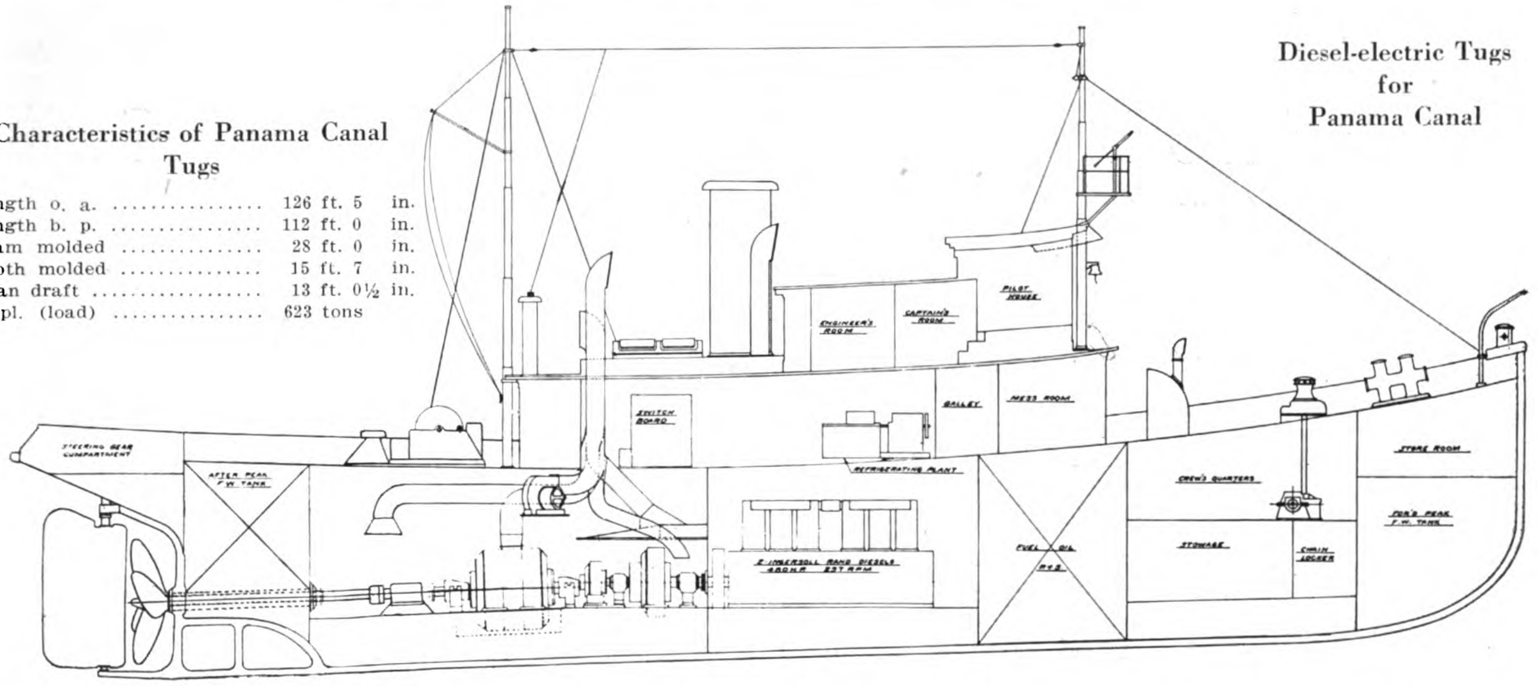
Each tug is equipped with a combination capstan and anchor winch built by the American Engineering Company, motor driven by a General Electric reversible series motor, capable of heaving in a 1000 lb. anchor in 30 fathoms of water at 30-ft. per minute.

Suitable cold storage spaces are provided and refrigeration is obtained from an Audiffren refrigerating machine.

The tug TRINIDAD which is being used as a combination harbor and sea tug by the Marine Division, having charge of handling ships through the Canal, will occasionally be called upon to make long trips at sea to service or tow disabled vessels. Because of this she is equipped with a 500 watt radio with a range of 1000 miles at night. The

*Assistant Supt. Mech. Div., Panama Canal.





Diesel-electric Tugs for Panama Canal

Characteristics of Panama Canal Tugs

Length o. a.	126 ft. 5 in.
Length b. p.	112 ft. 0 in.
Beam molded	28 ft. 0 in.
Depth molded	15 ft. 7 in.
Mean draft	13 ft. 0½ in.
Displ. (load)	623 tons

tug TRINIDAD is equipped with an electrical towing machine built by the Markey Machine Company of Seattle.

The tug CHAGRES which is being used by the Dredging Division, while available for emergency sea trips, is used primarily for towing barges from the dredges to the dumping grounds and in servicing the dredging equipment of the Canal. One of the dumping grounds for spoil from the Canal is at sea. This tug has accordingly been equipped with an Allan-Cunningham full automatic towing machine with an in-haul capacity of 75-ft. per m. at 25,000 lb.

The hulls of these tugs are very rugged throughout and have been so designed that if any one compartment is bilged the tug will remain afloat. This has been accomplished by separating the Diesel engine room from the electrical machinery room by a solid water-tight bulkhead. This bulkhead also serves to prevent the oil laden atmosphere of the Diesel engine room from coming in contact with the electrical machinery.

The tugs were built for operation in Canal Zone waters where the average air temperature is 88 deg. Fahr. Under these conditions ventilation of the electrical machinery room was a primary problem. The problem was rendered more difficult by the necessity of completely covering the main generators and exciters to guard against the sudden heavy rain squalls of the Canal Zone having access to the electrical machinery. The problem was met by mounting a 6000 cu. ft. Sturtevant-General Electric blower whose suction was taken from between the two halves of the main propelling motor and carrying the discharge up the center line to a breaching, the two outboard legs of which were connected to the hoods of the generators and exciters. This arrangement will be made clear by reference to the inboard profile plan. In this way the main motors which operate at low variable speeds are given the primary ventilation and the generators and exciters which are operating at a relatively high constant speed were given natural stack ventilation augmented by the jet action of the blower discharge. Natural cowl ventilation for fresh air was provided at three points, aft of the main motors and outboard on each side of the main generators.

Each tug was given a rigorous acceptance test consisting of an eight-hour dock test at 750 s.hp. and 100 per cent slip and a sea test of six hours running at 750 s.hp. followed by a run at 900 hp. until all temperatures had equalized. The propelling machinery passed these tests easily.

Handy Harbor Motortanker

The harbor motortanker G. F. BRADY was converted from steam to Diesel power by Ira S. Bushey & Sons, Inc., Brooklyn, last year. The vessel was placed in service June 1, 1927, and has been in continuous operation ever since except for a 5-hour tie-up for minor hull repairs. She is operated by the Spentonbush Fuel Service, Inc., in New York harbor and Long Island Sound as far as Providence, R. I.

Motortanker G. F. BRADY is 115 ft. in length o.a., 23 ft. beam molded and has a draft loaded of 7 ft. The three cargo tanks have a combined capacity of 60,000 gal., and are loaded or discharged by means of two gasoline engine driven 4 in. rotary pumps having a capacity of 9000 gal. per hour.

The craft is propelled by a 6-cylinder 180 hp. Fairbanks-Morse Diesel engine which provides a speed of 10 knots light or 8 knots loaded.

The Spentonbush Fuel Service is now building a new coastwise motortanker, having a capacity of 180,000 gal. which will be propelled by a 360 hp. Fairbanks-Morse Diesel. The new vessel is expected to be put in service by August 1 of this year. Her owners expect great economy of operation.

Ms. G. F. Brady is a 60,000 gal. gasoline carrier converted from gasoline to Diesel drive

New Auto Ferries for Golden Gate Ferry Co.

Owners Thorough Satisfaction with Existing Ships' Performance Leads to Placing of Contracts for More Powerful Vessels

DIESEL-ELECTRIC automobile ferries are still growing in number on San Francisco Bay. Nine ferry boats using this type of propulsion have been delivered thus far, a new one has just been placed in service, and another is under construction for the Golden Gate Ferry Company. The two new ships are similar to those completed last year—the GOLDEN BEAR, GOLDEN POPPY and GOLDEN SHORE—except that the Diesel units are three 460 b.hp. Ingersoll-Rand Diesels in each ship instead of three 400 b.hp. Ingersoll-Rand engines. This is convincing evidence that the Golden Gate Ferry Company has found Diesel-electric equipment to be more economical and reliable than other types of propulsion for this service.

At this time a brief resume of some of the advantages of Diesel-electric drive should be in order, especially for the information of those who may have just recently become interested.

The economy of the Diesel engine is so well known that it hardly needs further discussion. For electric propulsion several relatively high-speed engines can be used, thereby reducing the weight per hp. per engine and at the same time advantage can be taken of the higher propeller efficiency at slower speeds by using a propeller motor of a slower speed than the Diesel engine. The greater number of engines makes a most reliable arrangement since the electrical equipment makes possible the use of the full power of the remaining engines in event that it should be found necessary or desirable to remove one or more from service. With a layout using three engines, approximately 87 per cent speed can be obtained with two engines in service, or 69 per cent with only one engine. This is particularly advantageous for ferry boats.

For a double end ferry of the type used by the Golden Gate Company, two motors are used, the one at the forward end, as the case may be, arranged to automatically run at slip speed so that practically no impedence to the progress of the ship is offered. A greater operating efficiency is thus obtained than can be had with a through shaft driving a propeller at the same speed at both ends. The variable voltage system is used so that control can be had from either of the two pilot houses or the engine room, but regardless of the control station in use, the proper ratio between the forward and after propelling motors is automatically maintained.

Pilot house control is a distinct advantage for this class of service. Of necessity, ferries must constantly operate in more or less congested waters, and ease and rapidity of control is of primary importance. With pilot house control, complete responsibility of operation rests with the pilot, who can start, stop or reverse at will, simply by manipulation of a lever on a pedestal within easy reach of the wheel.

Ms. Golden Poppy Characteristics

Length overall	240 ft. 0 in.
Beam mld.	44 ft. 0 in.
Beam (over guards)	60 ft. 0 in.
Depth at center	17 ft. 0 in.
Draft	13 ft. 0 in.
Gross tonnage	780 tons
Speed	13 knots
Capacity	85 autos and 350 passengers

Ms. Golden Poppy, an 85 auto, San Francisco Diesel-electric ferry

Ms. GOLDEN POPPY reveals the experience gained in the development of an auto-ferry fleet. The engine room commands considerable interest. Upon entering, one is particularly impressed with the quiet running of the Diesels. The auxiliaries and engines are very accessible and the arrangement of the units is simple and flexible.

The main engines are three 6-cylinder Ingersoll-Rand Diesels of 14 in. bore and 19 in. stroke, operating at 265 r.p.m. Each engine operates a 270 kw. direct connected generator and a 40 kw. exciter, also direct connected. Each main engine is provided with a quiet operating valve gear and an efficiently designed, noiseless suction muffler. The fuel system is of the double-valved Price-Rathburn system, served by a distributor and single plunger pump for all cylinders.

The lubricating oil system consists of an oil pump for each engine, which transfers the oil from the base of the engine through an oil strainer into a pressure tank, from which it passes through an oil cooler, back to the force feed manifold at about 25 lb. pressure.

Circulating water is provided by a separate motor-driven rotary pump of sufficient capacity to take care of all three engines. The circulating water circuit through the engines is arranged to cool the hottest section surrounding the combustion chamber at the most effective rate.

The engine bedplate is provided with a deep, stiff extension to preserve true alignment of the generator and exciter shafts.

The electric propelling machinery and electric auxiliaries for the three boats placed in service in 1927 was furnished by Westinghouse Electric & Manufacturing Company, and the latest ferry, the GOLDEN AGE, is a repeat order for practically duplicate equipment. In these ferries, two motors are used, each of which will deliver 950 hp. when operating at a speed of 180 r.p,m. They are of the open type and are mounted on bedplates in order to provide a rigid foundation—the hulls being of wood. Each motor shaft is supported by two pedestal type marine bearings, lubricated by a central disc which dips into the oil well. The oil is deflected by a special arrangement. By this means ample lubrication is assured regardless of the speed or direction of rotation.

The three main generators are connected in series while the propelling motors are connected in parallel. The entire control of the propelling motors is accompanied by manipulating the main generator fields. A forward movement of the control lever causes current to pass into the generator fields, thus providing ahead rotation of the

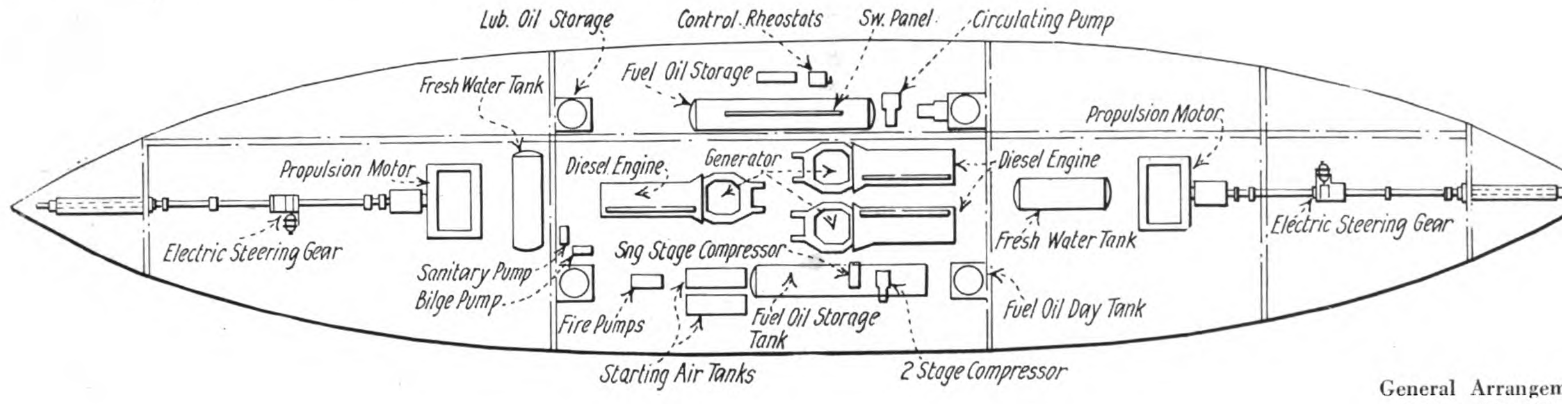
(Continued on page 329)

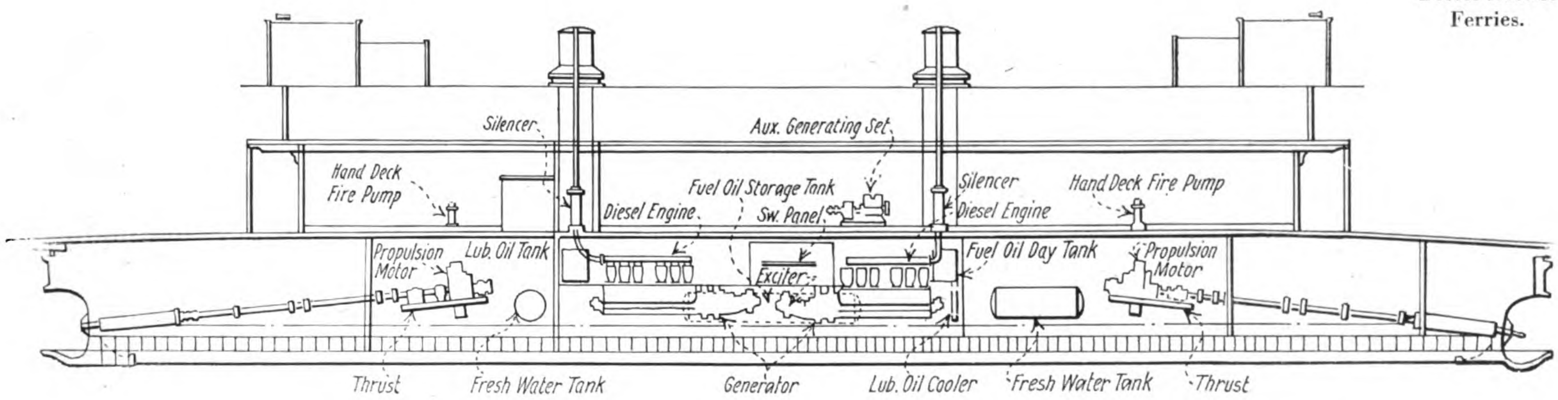
(Continued from page 326)
propelling motors.

The fields of the propelling motors are shunt wound and separately excited and therefore the speed and direction of rotation depends upon the direction and magnitude of the power applied to the armatures of the propelling motors. This is controlled through the main controller by regulation of the generator field excitation. Auxiliary contacts are also provided in the main controllers, which so regulate the motor fields, that the forward motor will speed than the forward motor. This causes the after motor to propel the ferry and the forward motor to rotate at "slip" speed as previously mentioned.

A double face-plate potentiometer type rheostat is used at each control station for controlling the generator field excitation, thereby controlling the generated voltage and the speed and direction of rotation of the propulsion motors, the motor fields being shunt wound and separately excited, at a constant potential. A hand wheel on the engine room switchboard is used for oper-

In each pilot house, in addition to the control pedestal for operating the pilot house control rheostat, is located an indirect illuminated meter panel upon which is located two ammeters for indicating the current flow in the forward and after motor circuits, and two r.p.m. meters, actuated from magnetos on the motor shafts, for indicating the forward and after propeller speeds. This enables the pilot to obtain a clear conception of the propelling motors when pilot house control is being used.





General Arrangement Golden Gate Co.'s Diesel-electric Ferries.

operate at a stronger field and therefore at a slower speed than the aft motor. The auxiliary contacts are so adjusted that the aft motor carries the full propelling load and the forward motor revolves at speed to overcome resistance of bow propeller.

Three main generators and three exciters are used on each boat. One main generator and one exciter, together with one of the three Diesel engines, composes an engine generator set. The generators and exciters are similar in construction to the propelling motors and each exciter armature is overhung on an extension of the generator shaft. Each main generator is rated at 270 kw., 250 volts, and each exciter, which is also used for auxiliary power, is rated at 30 kw., 115 volts.

The control arrangement is such that the three main generators are connected in series with one propelling motor, the second motor being in parallel with the first. A generator "set-up" switch is provided for each main generator. These are used for removing any one or more generators from the propulsion circuit and completing the series circuit with the remaining machines. By means of a system of rheostats and contactors which are actuated by auxiliary contacts on the controlling reversing rheostat, the after propelling motor automatically has weakened field established, thereby causing it to operate at a higher

ating the engine room rheostat, and a pedestal is provided in each pilot house for operating the pilot house reversing rheostats through a shaft and bevel gears, from a lever on the pedestal. A system of transfer switches is provided for selecting the control station desired for use.

The entire excitation load is placed on one exciter. Power for auxiliaries and lights is obtained from the remaining two exciters, the auxiliary busses being arranged so that the load can be divided between the machines at will.

A number of protective features are provided, such as an overload relay which is set to operate only on extreme overloads such as might be occasioned by jamming the propeller; engine failure relays which prevent the generators from motorizing and reversing the engine should one stop for any reason while in service; and a ground detector voltmeter for the propulsion circuit and ground detector lamps for the exciters. The overload relay functions to open the main excitation contactor, thereby de-energizing the field circuits of the main machinery. To re-close this contactor, it is necessary to return the controlling reversing rheostat to the off position. This prevents the application of full voltage to the propelling motor in one step, thereby causing possible injury to the equipment.

The engine room auxiliaries have elicited as much comment as the driving mechanism, owing to the convenience and flexibility of operation which they provide. The engine crews, in particular, have expressed themselves as pleased with these facilities.

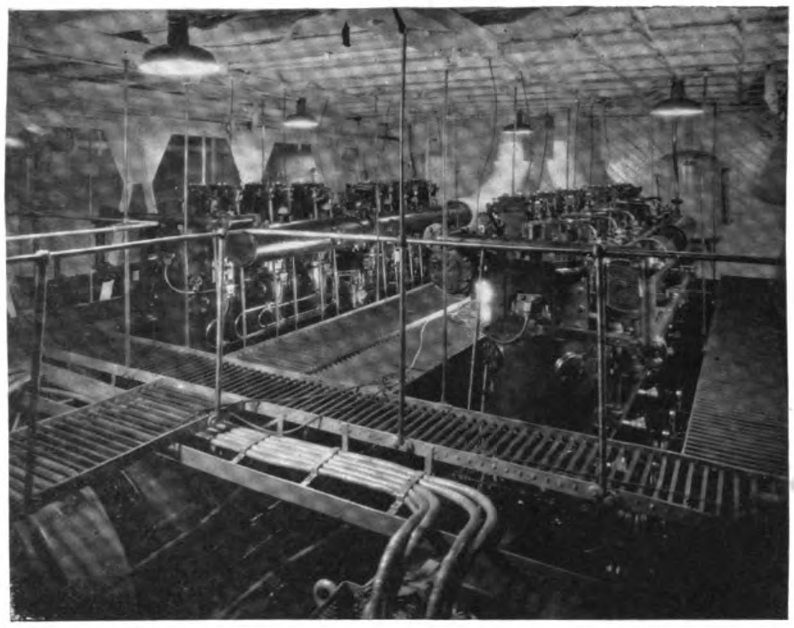
The arrangement of the auxiliary compressors is novel and flexible. One single stage $4\frac{1}{2}$ in. x 5 in. Ingersoll-Rand air compressor and one 5 in. $2\frac{1}{4}$ in. x 4 in. 2-stage Ingersoll-Rand air compressor, furnish air to two air receivers. The piping is so arranged that both compressors may discharge into one receiver. Both compressors will operate up to a pressure of 150 lb. when the single stage compressor will automatically cut out and the 2-stage compressor will boost the pressure to 300 lb. By this arrangement, it is possible to start all three Diesel engines in 15 min. from an empty tank. During ship operation, the second tank is maintained automatically at a pressure of 100 lb. to serve the whistles.

A 32 hp., 5 in. x 7 in. Colo Diesel, operating at 750 r.p.m., drives a 24 kw., 115 volt Westinghouse generator, installed on the main deck as an emergency generator set. This engine can be started by hand without any heating appliances. The auxiliary pumps are Westinghouse, motor-driven, and consist of fire and bilge, fresh water, fuel oil service, lubricating oil service and cir-

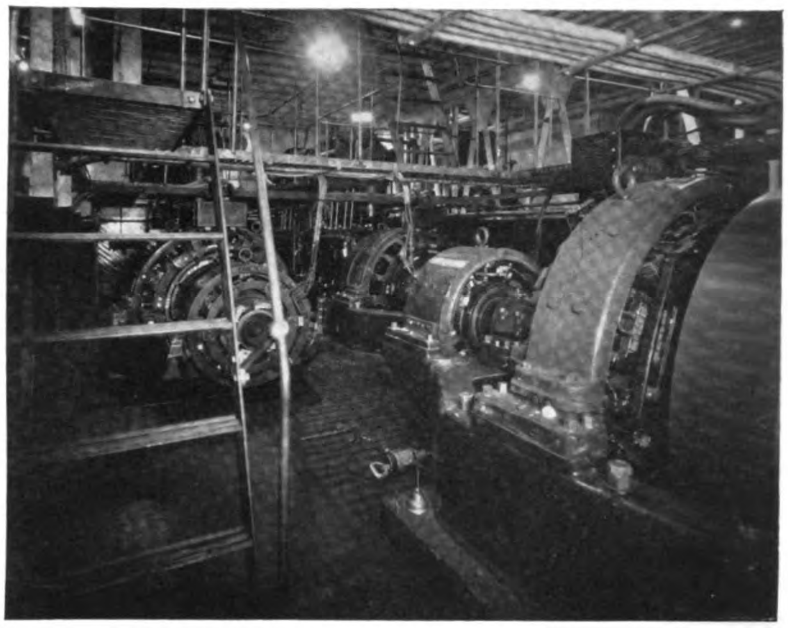
culating water pumps. It should be noted that the hull and superstructure are of wooden construction. The hull is staunch and rigid and is reinforced for approximately 70 per cent of its length by two steel fabricated trusses running all fore and aft.

The upper deck is arranged for the convenience of the passengers. The galley and lunch room are located on one side and the enclosed men's smoking room and comfortably furnished ladies' rest room, are located on the opposite side of the saloon deck.

The entire ship reflects thought in producing an efficient, economical, simple and comfortable automobile ferry.



Here are two of the three main 6-cylinder Diesels



Three 270 kw. main generators and 30 kw. exciters

New Japanese Motorliners

THE first of the N. Y. K. Line's motorliners for its California-Orient service, three of which are under construction in Japan, will be launched next September at the Mitsubishi dockyard in Nagasaki. The Nagasaki yard is building two of the liners, while the Yokohama Dock Company of Yokohama is building the third ship, construction on which was started February 6th. They will cost $6,000,000 each.

The first two ships will be named for Japanese shrines, the ASAMA MARU and the TATSUTA MARU, while the third, likewise named for a shrine, also honors Crown Prince Chichibu. She will be named CHICHIBU MARU.

Distinctive Appearance

The vessels will be distinctive in appearance, with their cruiser-like profile. The first two ships will be engined with four sets each Sulzer Diesels which will develop 20,000 horsepower and maintain a sea speed of 19 knots. MS. CHICHIBU MARU will have two double acting Burmeister-Wain engines also developing 20,000 horsepower. The first two liners will be quadruple screw and the last named twin screw. The gross tonnage will total 16,500. They will be 585 feet in length with a beam of 72 feet on the two ships building at Nagasaki and a 74 foot beam on the last of the trio. The depth will be 42 feet 6 inches. They will accommodate 200 passengers in the first cabin, 100 second class and 500 third.

The seven decks are connected by elevators and stairs, including special elevators for ship's officers.

Safety has been considered and the liners will have a double bottom, watertight bulkheads, fireproof compartments, etc.

The safety equipment includes also a Sperry gyro-compass.

The passenger accommodations have been the subject of much study by the Nippon Yusen Kaisha engineers and architects. They will attain considerable comfort and convenience, especially the suites de luxe which include private outdoor verandas. The decorations in the public rooms will be typical of Japan's early arts. It is currently reported that the new motorliners will have greater refrigeration spaces than any ships now in the transpacific passenger service.

Steam to Diesel for Fish Carrying

To obtain greater speed and reduce operating costs, the 300 i.hp. compound steam engine of the freighter SAN ANTONIO has been replaced by a 360 hp. Fairbanks-Morse Diesel engine. MS. SAN ANTONIO has an o.a. length of 138 ft., a beam of 24 ft., and an average draft loaded of 9½ ft. forward and 11 ft. aft.

Fish carrier San Antonio converted from steam to Diesel drive

Under steam power the vessel had a speed of 8 knots in calm water. With her Diesel engine, she has been reported to be averaging about 12 knots at a fuel consumption of approximately 125.5 lb. per hour.

MS. SAN ANTONIO is used for transporting fish from Montevideo to Buenos Aires. She is scheduled to leave Montevideo late in the afternoon and arrive at Buenos Aires before four o'clock of the following morning. The ship has been in operation for over six months without having a moment's delay in the schedule.

New Type Piston Ring

Tage Madsen, President of the Davy Robertson Engineering Company, Gothenburg, is visiting the United States about the middle of April. Mr. Madsen for many years was Superintendent Engineer of the Trans-Atlantic Steamship Company, owners of many Diesel-driven vessels, and on several occasions made round-the-world voyages on his company's motorships in order to secure first-hand information on the operation of the Diesel Engines.

The Davy Robertson Company has produced a new type of Diesel piston ring for the purpose of giving better compression and reducing the number of rings per piston. The ring is best described as a flat piston ring with a step which fits into a recess milled into the groove on the piston. This wearing ring is put into the groove, after which the piston ring of ordinary width is put into place, the wearing ring now taking all the wear which the pressure edge of the groove was subjected to before. The special cast-iron of which these wearing rings are made withstands wear much better than the softer material of the piston. The outside of the wearing ring does not lie flush with, but slightly within the outer surface of the piston. A small clearance is allowed for between the inner edge of the wearing ring and the piston wall, whilst between the underside of the step and the recess is an even smaller clearance. The outer edge of the step lies close up to the corresponding side position. Worn piston rings are easily replaced without preparatory filing with original width rings. A thicker wearing ring means a narrower piston ring, with a consequent reduction of liner wear.

The object of Mr. Madsen's visit is to make a manufacturing arrangement in the United States with an experienced piston ring company for the production of this new ring he has developed.

Diesel-electric Power for River Craft*

A Discussion of the Advantages of Fitting This Type of Drive to River Towboats, Ferryboats, and Excursion Boats

by R. A. Beekman†

THE high efficiency of the Diesel type of prime mover is the principal claim put forward for it and further silt and acid found in the water of most rivers is a disadvantage to steam equipment. With the above remarks as a point of departure I shall pass to the consideration of the advantages of interposing electrical machinery between the Diesel engine and the driven member, i. e., the paddle wheel or screw.

While all of the following Diesel-electric advantages may not be claimed for all classes of vessels and services, it seems desirable to point out that with this form of drive there is:—

Greater economy, due to the ability to shut down part of the plant, when full power is not required.

Greater reliability, due to multiplicity of units.

Greater facility in maneuvering, due to pilot house control and the variable gear characteristic of electric drive.

Higher maintained speed of vessel under different load conditions, due to the variable gear characteristic.

Motor speed adaptable to actual requirements after installation without sacrificing power or limiting the prime mover design.

Provision for accurate measurement of performance, thereby preventing unintentional overloading of the engines with consequent increase in maintenance and decrease in reliability.

Flexibility in the design of the vessel, due to the ability to place the engines in the most advantageous location without resorting to long shafting.

Use of the power plant for multiplicity of purposes such as driving dredge or fire pumps, etc.

River Towboats

In view of the type of cargo and the methods of handling same, which are found on the Mississippi and its tributaries, the push or towboat seems to offer by far the greatest field. The applications to date have been made by the U. S. Army Engineers and consist of two 100 ft. and three 70 ft. push boats in operation with one 110 ft. under construction. One of the 100 ft. boats is operating in the St. Louis District, and the 110 ft. under contract with the same district.

These vessels are all of the stern wheel type, and it seems to be the opinion of the majority of river men that the stern paddle wheel is best suited to the conditions. The power demand by the paddle wheel is dependent upon the number and load of the barges being handled, the depth of the channel, the velocity of the current, etc. With the Diesel engine directly connected to the wheel through mechanical means, the full load can be dedeveloped and absorbed at only one speed of the engine. If the conditions demand a reduction in speed, this is accompanied by corresponding reduction in power available and hence a slowing down of schedule. If, on the other hand, the conditions call for an increase in speed this can be met only at a sacrifice of life of the engine. With electric drive the engine speed may be maintained constant over the entire range of vessel speed, because the necessary change in ratio between the paddle wheel and engine speeds may be obtained electrically. In the earlier installations this was accomplished by changing the motor fields but in the latest 110 ft. boat TECUMSEH, now building, this is to be accomplished in a novel manner.

In this case the electric generator is so designed as to demand practically constant horsepower of the Diesel engine with only about 5 per cent drop in speed on the engine itself, while the motors driving the stern wheel have a speed range of approximately 1.6 to 1. This has the great advantage of operating automatically, while with motor field adjustment it is necessary to rely on the operator to make the necessary change.

Diesel-electricity gives economical and efficient propulsion for ships of this type

It should be understood that the speed of the vessel is at all times under the control of the pilot house by means of varying the separately and self-excited fields.

Hardly too much emphasis can be placed upon the maneuvering ability of this type of drive. In narrow and congested channels, in coming alongside of docks and in handling the tows, this is an extremely important factor. Pilot house control allows the pilot to have directly at hand the means for controlling the speed and direction of the wheel, so that the response to his needs is immediately without delay and possible confusion in transmitting signal to the engine room. There is only one way to convince oneself of the advantages of this type of drive and that is to actually see the operation or better still to try one's hand at it. In all classes of service to which we have applied pilot house control we have received great opposition, and there has been much skepticism at the start but in each case, after a very short experience with it, the operating personnel has been completely won over. Of course, it is understood I am referring to a very much larger field of experience than has been had on the few river boats in service.

Even with the great experience which has been had in building boats and the data which thereby has been made available, it is not easy to determine absolutely the best speed of the wheel. If the Diesel engine is directly connected, the speed chosen can be changed to suit the wheel only by sacrificing power or length of life, the former in case the speed has to be lowered and the latter if it has to be speeded up. It is quite easy to provide for this adjustment in the motor field of an electric drive equipment. It should be understood that this is in the nature of a permanent adjustment, which may be made when the boat has its trials and is not the same type of speed change as described previously.

To date the applications have made use of a series connection of the generators and propelling motors. This grew up out of the character of load imposed by the screw type propeller in seagoing vessels, and it also has advantages in the case of the paddle wheel. The whole question revolves about the governing means on the engine and hence the distribution of the load, hunting, etc. If the future development of paddle wheel boats indicates the desirability of parallel operation, the indications are that this is feasible due to the difference of the torque characteristics of this type of wheel, as compared with the screw type and also the difference in service.

While to date the installations which have been made on rivers have not called for operation of the vessel at reduced power over an appreciable length of time, yet it is quite likely that in the future in studying definite schedules the need for slowing down and speeding up between certain points will develop in this class of service. In this case the electric drive again has the advantage, inasmuch as it allows of the multiplicity of units, a part of which may be shut down under reduced power demand and the remaining units operated at full load and hence with high economy.

River men seem to be quite unanimous in their feeling that a stern wheel boat handles considerably better when it is "down by the head"; i. e., with the bow drawing somewhat more water than the stern. If this be accomplished by making the stern with greater displacement, some loss in propulsion efficiency is encountered. It is, therefore, apparent that flexibility in the distribution of machinery is of some importance. With the Diesel-electric drive the only part of the equipment which need be located aft is the motors. The engine generating sets may be located forward in any convenient location and position, while this can be done with direct drive only with long shafts and complicated mechanical connections.

Ferryboats

The greatest number of Diesel-electric installations have been made in this field, but the ferries with two exceptions are in service in the harbors of large maritime cities, such as New York and San Francisco. However, there is no reason why river ferryboat service is not open to the same application and for the same reasons.

Of the two installations on rivers, one is at Louisville, Kentucky, and the other is on the Hudson at Poughkeepsie, New York. The

*Abstract of a paper presented to the Engineers Club in St. Louis, Mo.

†Federal & Marine Dept. General Electric Co.

former is of the sidewheel type, while the latter is driven by screw propellers.

Many of the advantages set forth for towboats pertain to ferries. The maneuvering and reliability features are even more important, due to the fact that the boats carry passengers. With the sidewheel type the special advantage mentioned in the case of the twin screw tunnel boat, also, applies; namely, that all of the prime mover units are available for driving either or both wheels, while with the direct-connected type the use of one wheel is lost in the event of failure of one of the engines; there are some cases where both side wheels are operated as one, but reliability and maneuvering ability are then sacrificed.

In the case of the ferryboat F. M. Coots, at Louisville, the size of the installation is such that the constant voltage system was chosen instead of the variable voltage. The motors are controlled in speed and direction in the usual manner by use of armature resistance. In the case of larger installations the variable voltage system is recommended.

While practically all of the Western river ferries are of the side or stern wheel type, there seems to be no reason why in some cases the screw propeller double ended type should not be used with advantage. I shall, therefore, point out a particular advantage of electric drive for this type of ferry.

These boats are constructed with a propeller at each end, and it has been found that the most ecenomical method of operation is to furnish all the propelling power to the stern propeller, while the bow motor is idled at such a speed, approximately 70 per cent of that of the stern, as to just furnish its own losses. In the case of direct drive, this arrangement is not feasible, unless separate engines are provided for each propeller.

With the electric drive it is possible to use but one set of prime movers and generators and to get the difference in speed desired on the two propellers by means of motor field adjustment.

Dredges and Snag Boats

Again in the case of dredges the application has been in installations for use near the coast or on the Great Lakes. However, the U. S. Army Engineers have been considering the use of Diesel electric drive on dredges and snag boats in the Mississippi, and I have no doubt that there will be an early application along these lines.

An advantage particularly applicable to these types of boats arises from the fact that considerable power is required for driving the special auxiliaries used. These consist of pumps, cutters, large capstans, etc. In fact the terms might well be inverted; in other words, the auxiliaries are used in connection with the work for which the vessel is constructed, while the propulsion is of secondary importance. There are installations in which the dredge is not self-propelled but is moved from place to place by external means. The electric motor is particularly well suited to driving dredge pumps due to the requirement of having constant horsepower over quite a range in speed.

Due to the fact that the power demand of the propulsion and the working load of these types of boats do not coincide, the power plant can be made available for both purposes. This can be done in the case of direct drive only by complicated clutches and mechanical arrangements and at the best is then a compromise.

Major Gotwals, U. S. Engineer of this district, has been considering reconditioning one of his snag boats along these lines.

Cargo Boats

This field, as far it it concerns inland waterways, has been entered but recently, and it seems to be a fertile one. At the present time there is being constructed a boat of about 125 ft. in length for transporting products manufactured by Johnson & Johnson from New Brunswick, New Jersey, to various points around New York and Brooklyn. It has been found desirable, due to the great congestion of traffic on the roads, to turn to the waterways as a means of transportation.

In this case the two main factors which caused a decision in favor of electric transmission are pilot house control and the point referred to above, concerning available cargo space. The cargo is not stored in holds but is placed on the main deck much as is the case with Mississippi River boats. The direct Diesel engine was of such a height as to cause serious obstruction on this deck, while the Diesel-electric installation can be placed below. Thus this deck is left clear for cargo. The advantage of maneuvering, reliability, etc., of course, apply in this case.

While the trend in the Mississippi and its tributaries seems to be toward push or towboats with barges carrying the cargo, yet there is no doubt that some portion of the field may be advantageously entered by the boat itself carrying cargo. In these cases the same advantages would apply as have been mentioned in the case of the Johnson & Johnson installation. In addition the handling of the cargo, gang planks, etc., can all be done electrically with power taken from the main prime movers instead of having separate apparatus for this purpose.

Fire Boats

Here, again, advantages arising from the use of the same power plant for both propulsion and pumps pertain. In addition some of the operators insist that it is necessary to have a small amount of power available for turning the screw over slowly in order to hold the boat against the reaction of the fire nozzles, especially under certain conditions of current, etc. Electrical transmission will, of course, meet this condition with the same flexibility as it does similar requirements in the case of independent operation of multiple screw boats.

An added item of economy in the case of fire boats enters in, due to the standby losses that are encountered in maintaining steam through long periods of idleness, as the boat must be prepared to respond at any moment to fire call. With the Diesel engine this standby loss is reduced to a minimum and with the electric drive, making use of multiplicity of units, overhaul can be carried on without completely losing the use of the boat.

Excursion Boats

In this field studies have been made, but up to the present there are no installations. However, due to the marked economy, which can be shown for the Diesel-electric drive in this field, it certainly seems that we should see a large installation in the near future.

Of all the fields this one probably brings out more strongly than any other the advantage of multiplicity of units. Take as example one of the large excursion boats leaving St. Louis twice daily during the summer for a trip down the river. During the time in which the vessel in going down stream only enough power is required to maintain steerage way. If a direct Diesel is installed, full advantage of the saving of power cannot be taken. With the multiplicity of units in the electric transmission system, this saving can be a maximum, if the proper number of units be chosen.

Most of these large pleasure boats are of the sidewheel type, and the installation of direct connected Diesels becomes difficult, due to the space and weight factor. With the electric transmission, as has been brought out previously, the prime mover units may be disposed as best suited to the conditions.

Pilot house control should be a very attractive feature with this type of boat, as it leads to maximum maneuvering ability, which is of prime importance with vessels of this size and character.

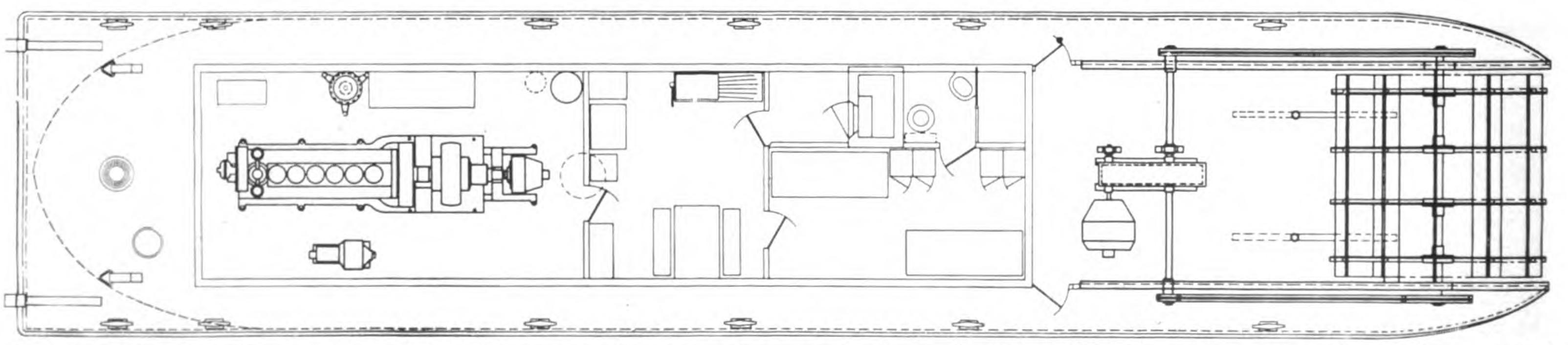
Sternwheel Drive

There is one feature of electric drive as applied to sternwheel boats, which has caused much thought on the part of everyone who has studied this problem. This concerns the mechanical connection of the motors to the wheel. In small sizes this has been successfully accomplished by means of shafts and gears or chains, but all of these offer grave difficulties when applied to boats demanding 1000 to 2000 hp. and above. When one realizes the large torques involved in consuming this horsepower at between 15 and 30 r.p.m., it is not surprising that this has been cause for concern.

After very careful analysis, several groups studying the problem independently have arrived at the conclusion that the use of connecting rods or Pitman's offers satisfactory solution. This type of connection has been successfully used for many years with the old grasshopper type of engine and certainly has demonstrated its merit.

However, difficulty arises with the Pitman type of connection, when we attempt to apply electric motors. In the case of the grasshopper reciprocating engine, steam is cut off before the end of the stroke, and the idle Pitman is carried over the dead center by the working one. With the electric motor, however, unless we resort to extreme complications the torque is applied continuously and there is grave danger that during maneuvering the driving cranks on either side of the vessel will be brought into opposition to each other. This is due to the clearances which naturally develop

(*Continued on page* 337)



Diesel-electricity for river boat propulsion cannot be criticized on the grounds of complication. This shows the compact layout for a typical towboat

Diesel-electric Power for River Craft

(*Continued from page 332*)

in the bearings, which will permit of a driving crank, when near dead center dropping by and causing a cramping action. This analysis is by no means based on theory only, as actual experience has been had with electric locomotive design, incorporating similar features.

Happily we have recently found a solution to this problem which we believe meets the requirements fully. We propose installing in the Pitman's a hydraulic connection consisting of a cylinder, piston and transmitting fluid, which are entirely self-contained, i. e., there is no piping external to the device itself. During the advantageous working angle of the crank the two ends of the cylinder on either side of the piston are sealed off from each other so that a rigid connection is maintained but as the crank approaches dead center, the two parts of the cylinder are interconnected by means of a valve mechanism, so that the piston is allowed to float freely, thereby permitting the working Pitman to carry the other past dead center, much as is the case with the grasshopper type engine.

This arrangement has the additional advantage of setting a definite limit to the stresses set up in the crank pins, Pitman rods, etc., due to the ability to choose the point at which the load is relieved on the side approaching dead center.

It should be understood that with this arrangement the driving cranks are cross connected, i. e., electric motors are not independently connected to the driving cranks. If this cross shaft were not provided, the motor connected to the idle crank would accelerate a little as each dead center is passed until all of the clearance provided for by the hydraulic connection would disappear, and we would not have a solution to the original problem.

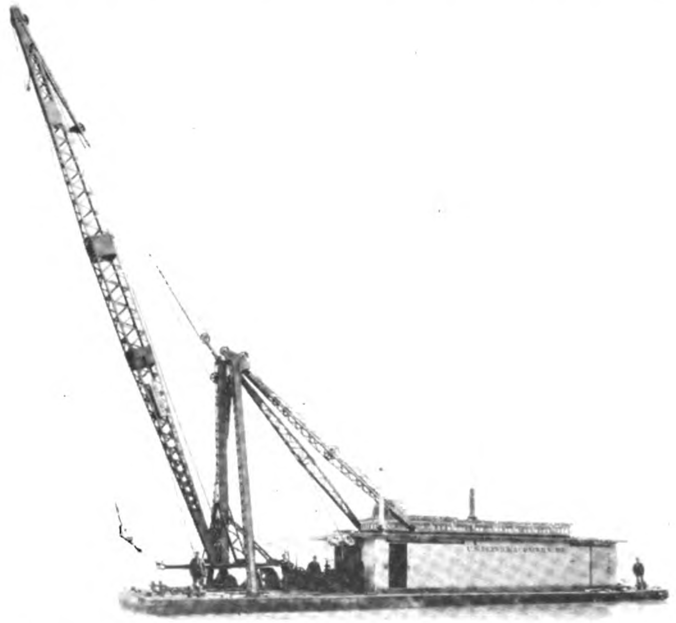
Levee Grading and Derrick Boat

IN connection with the work of river improvement a special type of grader and derrick boat has been developed for use by all government river improvement departments and by private contractors who handle government work on the rivers. Vessels of this type are fitted with pumping equipment for supplying the high pressure streams which are used in washing down the levees preparatory to placing riprap, or rock protection, and some type of derrick with hoisting equipment is fitted for handling the rock and other material for such work. The boats are also used for loading and unloading at the depot, transferring material or equipment from one boat to another or other similar general utility purposes. In the past these vessels have been equipped with steam engines, but recently the Diesel has begun to make inroads into this field.

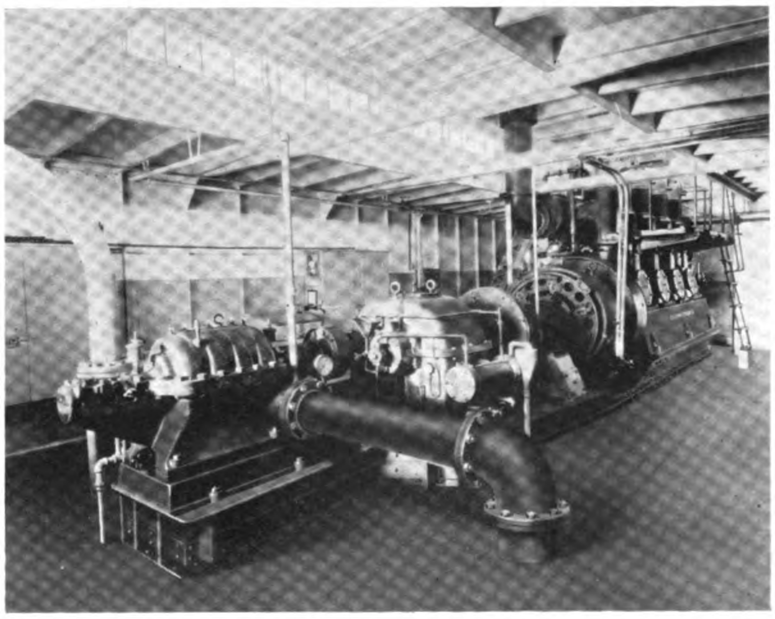
Last Fall a new levee grading and derrick boat was placed in service by the U. S. Engineers of the St. Louis district, and powered by a 240 hp. Fairbanks-Morse Diesel engine. The machinery is mounted on a standard 85 ft. by 26 ft. by 4 ft. steel pile driver hull which has a draft of 2 ft. 2 in. The Diesel engine is direct connected to a 50 kw. F-M direct current generator. Beyond the outboard bearing is a 32 in. combined Cutler-Hammer magnetic clutch and a Francke flexible coupling which connects through a Poole speed transformer to a 6 in., 4-stage F-M centrifugal pump rated at 1,000 g.p.m. against 226 lb. pressure. The o.a. length of the combination is 31 ft. 9 in. This pumping unit supplies the three nozzles for various grading operations.

The derrick equipment consists of a 35 hp. motor which drives the main hoisting engine, and a 10 hp. motor which drives the swinging engine. The normal working load for the derrick is approximately 5,000 lbs. The derrick equipment was supplied by the American Hoist and Derrick Co.

The plant was completely assembled and installed at the U. S. Engineers' depot at St. Louis under the supervision of their mechanical superintendent, Mr. Sanford. While the boat has not been in service long enough to make it possible to secure a detailed cost comparison to show the economy of operation, preliminary figures indicate that the saving as compared with steam equipment will amount to a very substantial sum. This is an important item.



A recent important Diesel application on the rivers—a levee grading boat



A 240 hp. Diesel controls the hoisting machinery through generator, magnetic clutch and flexible coupling

Lubrication

The Texas Company of 17 Battery Place, New York City, recently issued Vol. 13 of "Lubrication" in bound book form. It is 7 in. by 10¼ in. in size, and has 145 pages, including index, comprising the 12 numbers of "Lubrication" magazine published during 1927. "Lubrication" is a technical monthly magazine issued by the Texas Company, and is devoted to the selection and use of lubricants with especial reference to Texaco petroleum products. It contains quite an amount of useful and interesting information for marine engineers.

Barclay Curle's of Glasgow have built a Doxford opposed-piston marine Diesel engine of 4,500 s.hp. in four cylinders, or 1,125 s.hp. per cylinder.

Another ship—the EURYBATES—with combination steam and Diesel engines of the Scott-Still type has just been completed in England. The twin engines of the EURYBATES are of 2,500 s.hp. at 105 r.p.m. The design differs from previous engines, there being seven single-acting cylinders in line, two of which operate on steam and five on the Diesel principle.

Motorliner Bermuda's Railroad Time

The big motorliner BERMUDA of the Furness Bermuda Line has been maintaining railroad schedule since she was placed in service in January. Due to dock at 9:30 a.m. every Thursday, she may be seen moving quietly up the North River between 9:00 a.m. and 9:30 a.m. ready for the tugs to nose her into her pier exactly on, or even a bit ahead of scheduled time.

The motorship SILURIAN, one of the largest single deck motorships in ocean trade, has been sold to Furness-Withy interests.

New Swedish Motortankers

THE first of a number of Swedish oiltankers contracted with Gotaverken, Gothenburg, Ms. ABADAN, ran her trials on February 25, and the fifth of this fleet of sisterships, Ms. RANJA, was launched on February 11. During trials, Ms. ABADAN attained a speed of 11.8 knots at an engine output of 3240 i.hp.

Ms. ABADAN and Ms. RANJA, as well as their sisterships, are standard Gotaverken motortankers built to the "F. K." system to the highest class of "Det Norske Veritas" under special survey, and also comply with the rules of the Norwegian and British Board of Trade. Their principal dimensions are as follows:

Length o. a.	422 ft. 7½ in.
Length b. p.	407 ft. 0 in.
Beam moulded	55 ft. 0 in.
Depth moulded to main deck	32 ft. 0 in.
Deadweight capacity	9,000 tons

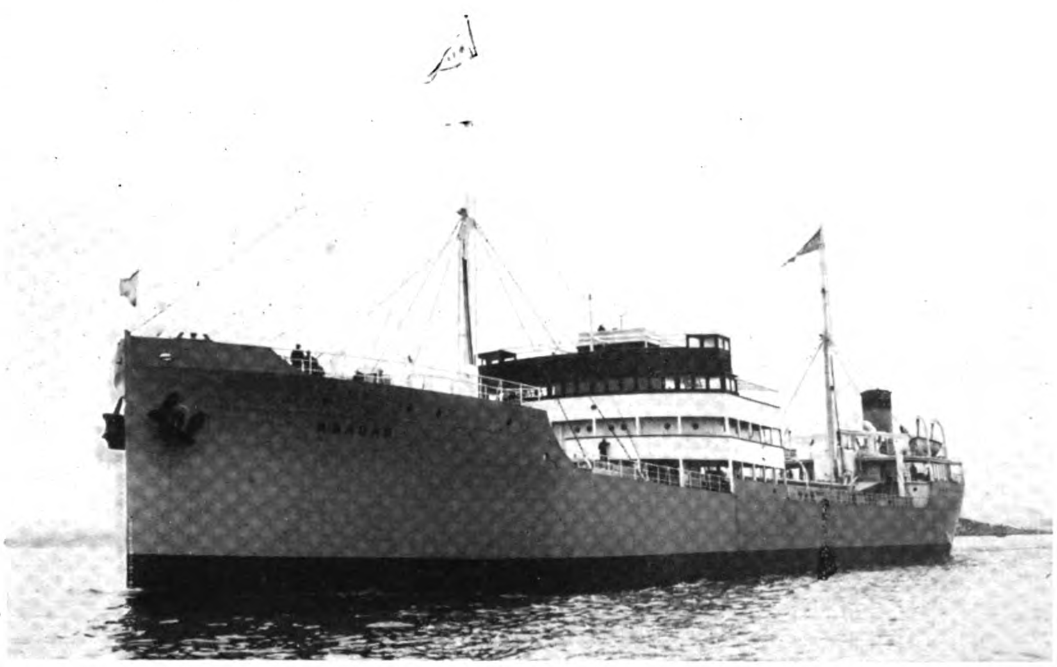
The propelling machinery consists of two 6-cylinder, 4-cycle, single-acting Gotaverken-B. & W. Diesel engines each developing 1400 i.hp.

Each vessel has 8 center cargo tanks, 4 wing tanks on the port side and 4 wing tanks on the starboard side, and is arranged to carry 4 different cargoes at the same time. To eliminate the possibility of getting the oils mixed due to a defective valve, double valves have been installed for every cargo suction strum. Steam driven gas ejector-pipes are fitted to all compartments. A cofferdam is installed between Nos. 4 and 5 tanks, and another one forward of the foremost cargo tanks.

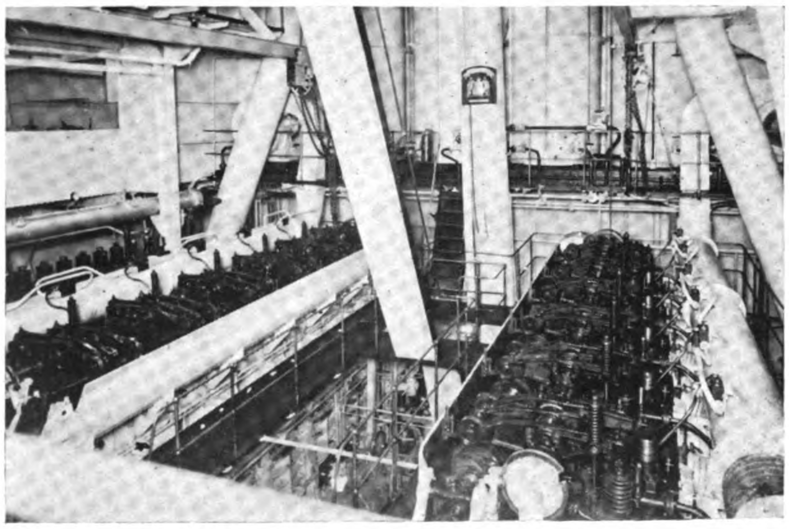
The cargo pumproom is situated aft and provides a space of isolation between the aftermost cargo tank and the engine room. There are two centrifugal and one bucket cargo pumps each with its own motor. The centrifugal pumps are directly driven by shafts carried in a box attached to the pump-room bulkhead.

All auxiliary machinery is electrically driven except for a small emergency steam driven compressor. Separators are used for both lubricating and fuel oil, and a separator has also been installed for oily bilge and ballast water. This is very up-to-date equipment.

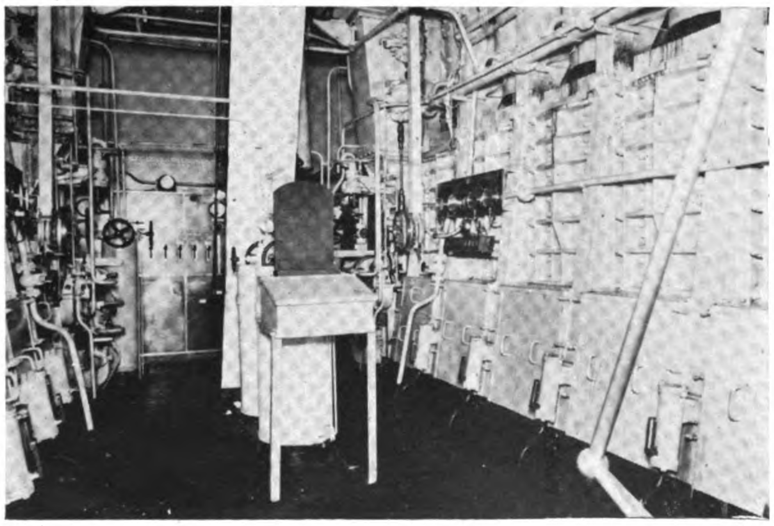
Accommodations are provided for the captain in the house on the upper bridge, while navigating officers have cabins in the lower bridge. Engineers are accommodated on the starboard side of the engine casing, with the crew quartered on the port side of the engine casing. This is a slight modification from usual tanker practice.



Ms. Abadan, one of the latest Gotaverken tankers, is powered by twin 3240 (collective) hp. 4-cycle Diesels



Characteristic cylinder tops of Gotaverken-B. & W. Diesels



Roomy control space between two main engines

Fast Motorship for New Zealand Trade

The efficiency and progress of the motorship is excellently depicted in the recently launched twin-screw motorship COPTIC, built for the New Zealand trade by Swan, Hunter and Wigham Richardson. Ms. COPTIC can carry considerably more cargo than a steamship of equal size, while her speed of 15 knots was unheard of in cargo liners a few years ago. She is, however, one of a large number of fast cargo liners built and projected—of speed impossible in steamers.

Ten Double-acting Diesels

An eight-cylinder, double-acting, four-cycle, 4450 hp. Diesel engine of the B. & W. type, has been completed by John G. Kincaid & Co. of Glasgow, for a single-screw "Clan" liner. The owners have since ordered a sister motorvessel. Altogether Kincaids have nine of these 4,450 s.hp. double-acting engines on order, eight of which are for twin-screw, 16 knot cargo-passenger ships for Furness-Withy & Co. for their new fast twin screw S. American motorships.

Gasoline to Diesel for Fishing Boat

The gasoline engine of the party fishing boat ELMAR, owned by Capt. Joseph Ecock of Sheepshead Bay, N. Y., is being removed at the yard of Jakobson and Peterson, Brooklyn, and a 80 hp. direct reversible Atlas-Imperial Diesel engine installed in it's place. The ELMAR is 81 ft. long o.a., 13 ft. beam on the waterline, and has a draft of 6 ft.

The Atlas-Imperial Diesel, which is being installed, is of the latest design.

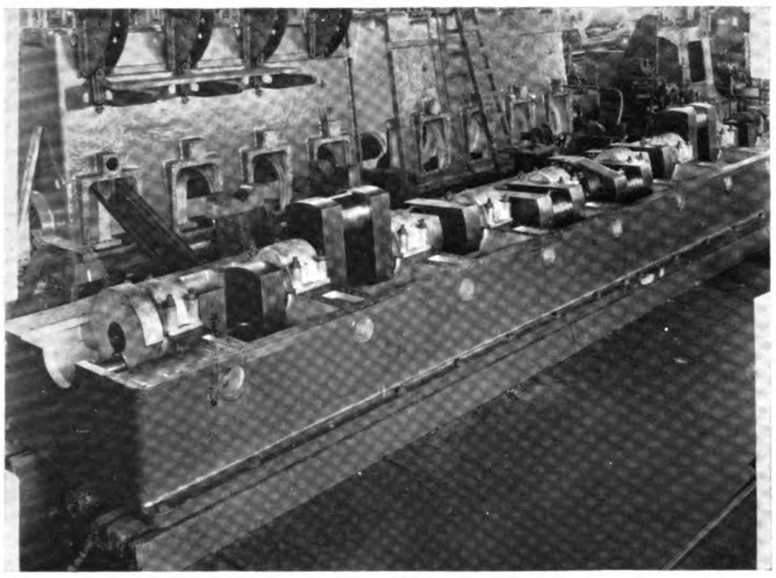
Fulton Co's Big Marine Job

A Total of 3600 Hp. Now Being Completed in St. Louis Shops for Big Panama Dredge

WE recently made a detailed inspection of the Diesel shops of the Fulton Iron Works, St. Louis, Mo., and were particularly interested in the progress now being made on the four large Diesels building for the new Panama Dredge. The unit we illustrate herewith was running test at the time of our visit. All four Fulton Diesel engines which are to be installed on the large Diesel-electric dredge for the Panama Canal will shortly be shipped to Baltimore and the dredge is expected to be placed in service during the summer. There are four 8-cylinder, 900 hp. units coupled to Westinghouse generators. These supply current for driving the main pump motor and for all power purposes on the ship.

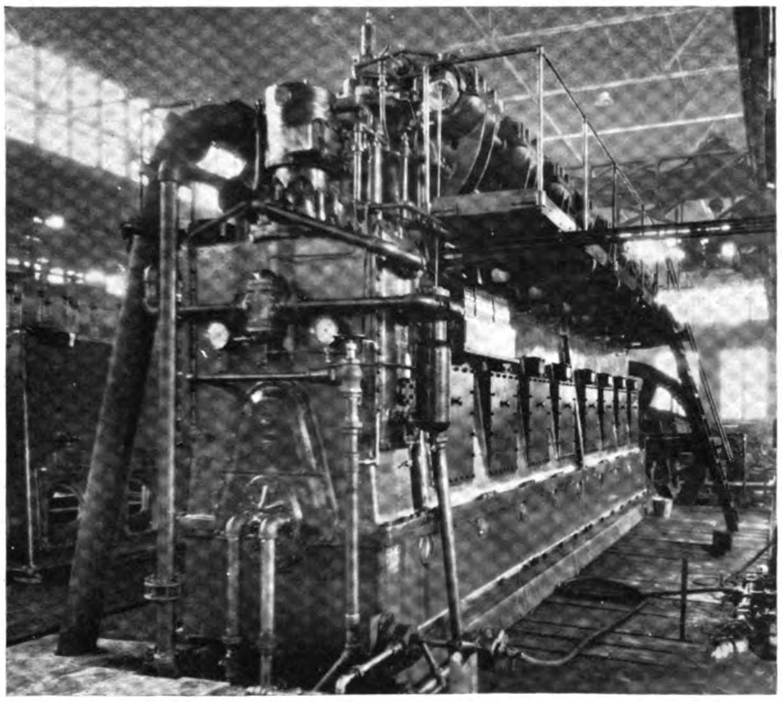
As we pointed out in the May, 1927, issue of MOTORSHIP, the dredge is under construction at Baltimore by the Ellicott Machine Corp. The hull has a length molded of 226 ft., a beam molded of 50 ft. and a depth molded of 14 ft.

Heavy duty will be required of the vessel in the Panama Canal Zone and three units will supply current for an electric motor driving a centrifugal, single-suction pump, with 26 in. diameter suction and 24 in. diameter discharge. She is to have an output of 2200 cu. ft. per min. of a mixture of water and solids with an average density of 75 lbs. per cu. ft. She must be able to dredge, in one swing, a cut 250 ft. wide at the full depth of dredging which is 60 ft. The Fulton Co. is now building auxiliary Diesels for the U. S. Shipping Board.

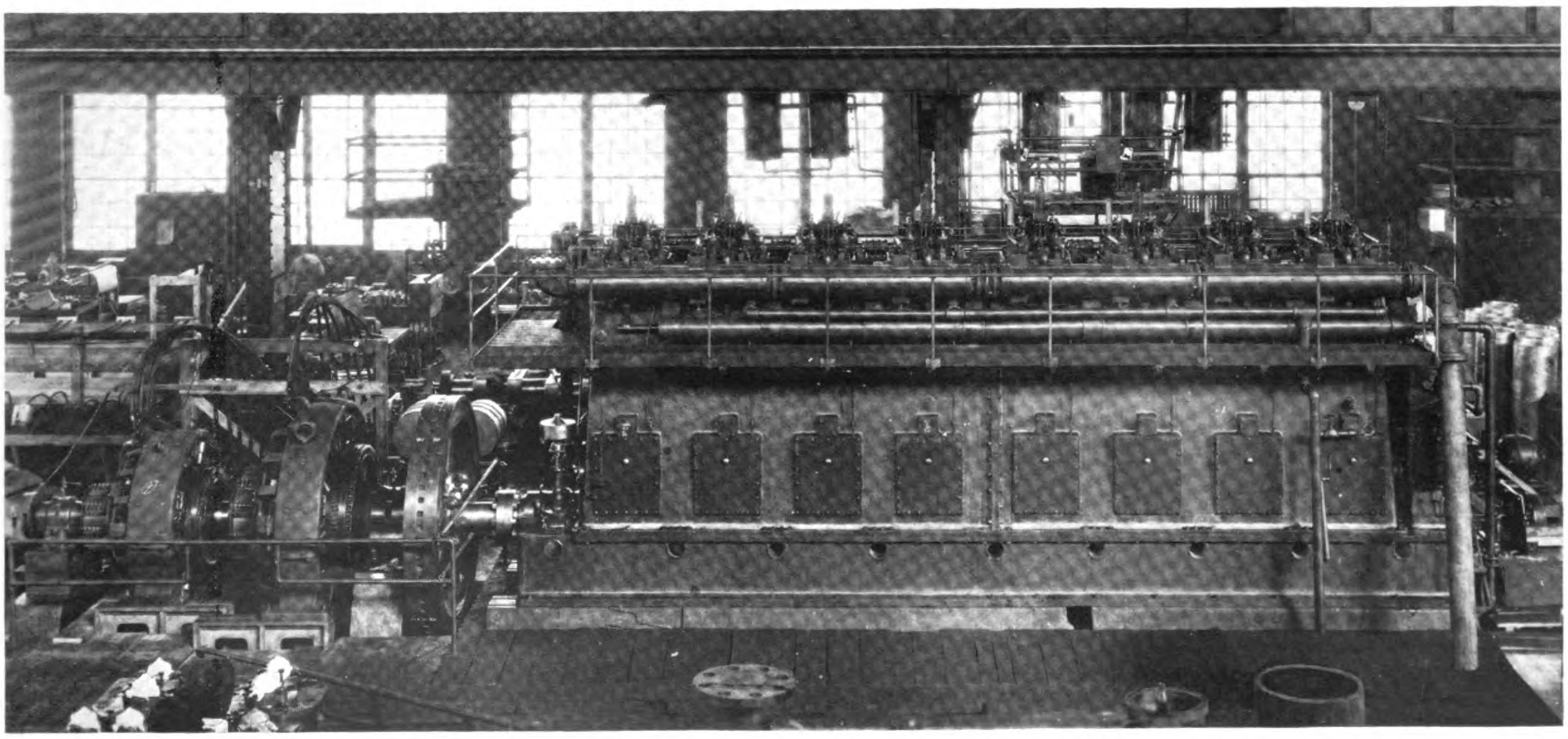


The Tifoco forged main crankshaft

Four Big Diesels for Panama Dredge

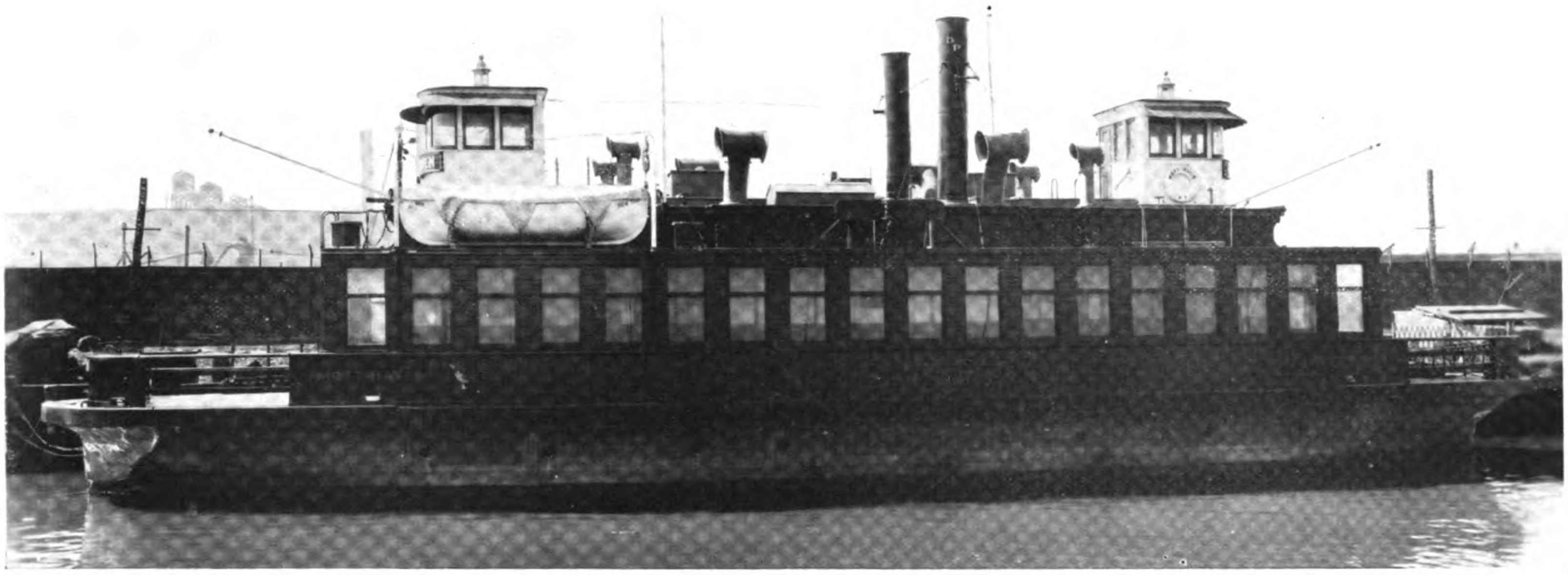


Forward end of engine, showing camshaft and injection air compressor

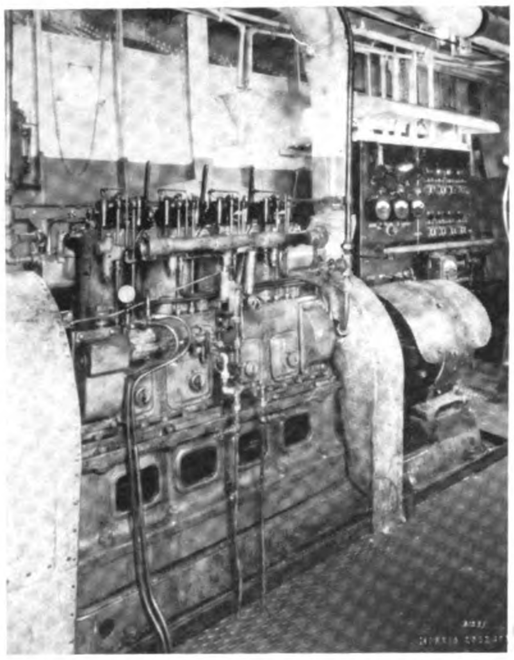


Adaptation of the Fulton Diesel to marine purposes is here seen in this 900 hp. unit on test. With three others it is intended for a big dredge now completing for the Panama Canal

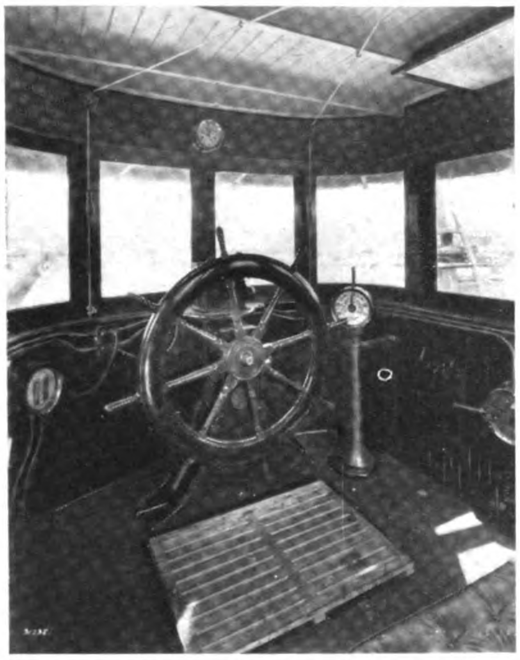
New York City's Newest Ferryboat—the Handy Nelseco Diesel Powered Mott Haven



Ms. Mott Haven is a typical double ended ferryboat 101.5 ft. over guards by 30 ft. extreme by 12 ft. depth molded. She was built by Todd Shipyards Corp., for East River service.

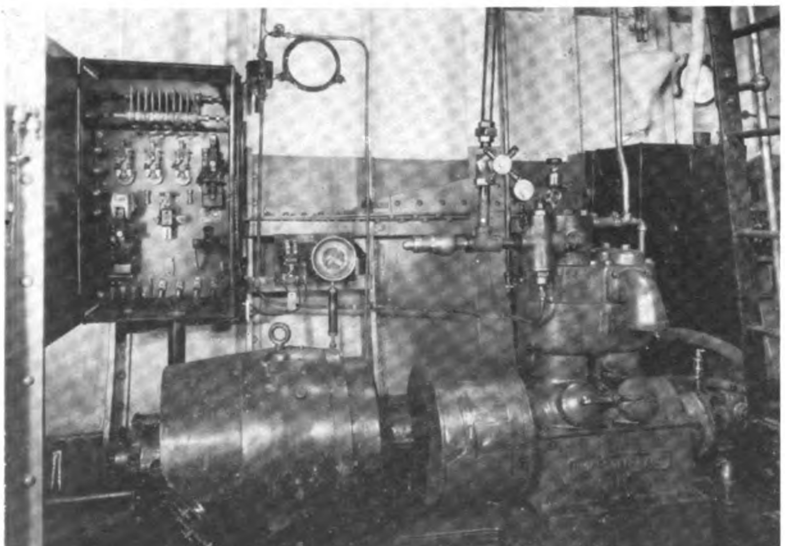


Hill Diesel auxiliary generator set

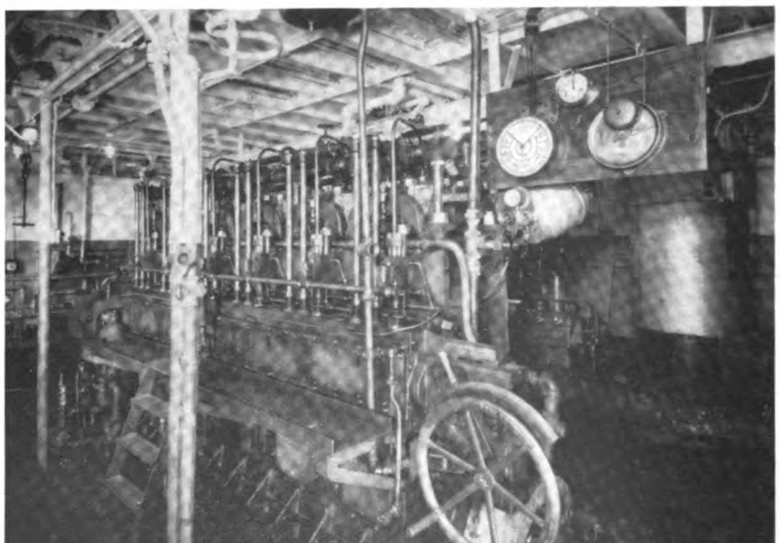


Pilot houses are roomy compartments

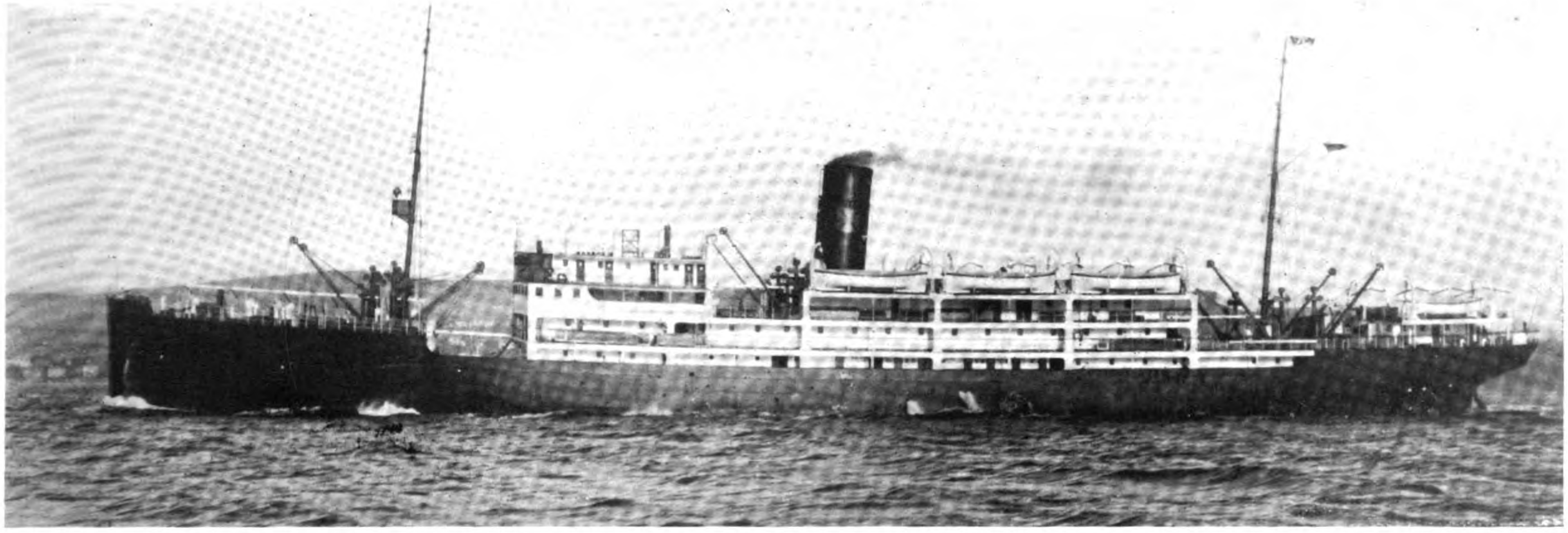
One of the two passenger cabins



Neat electric auxiliaries like the above air compressor characterize the engine room



The main 300 hp. 6-cylinder Nelseco Diesel operates a screw at each end at 250 r.p.m.



Fast Motorships in Coastwise Trade

Brazilian Owners Desiring Economy of Operation Using Fleet of Eight Ships with 2-cycle and Supercharged 4-cycle Diesels

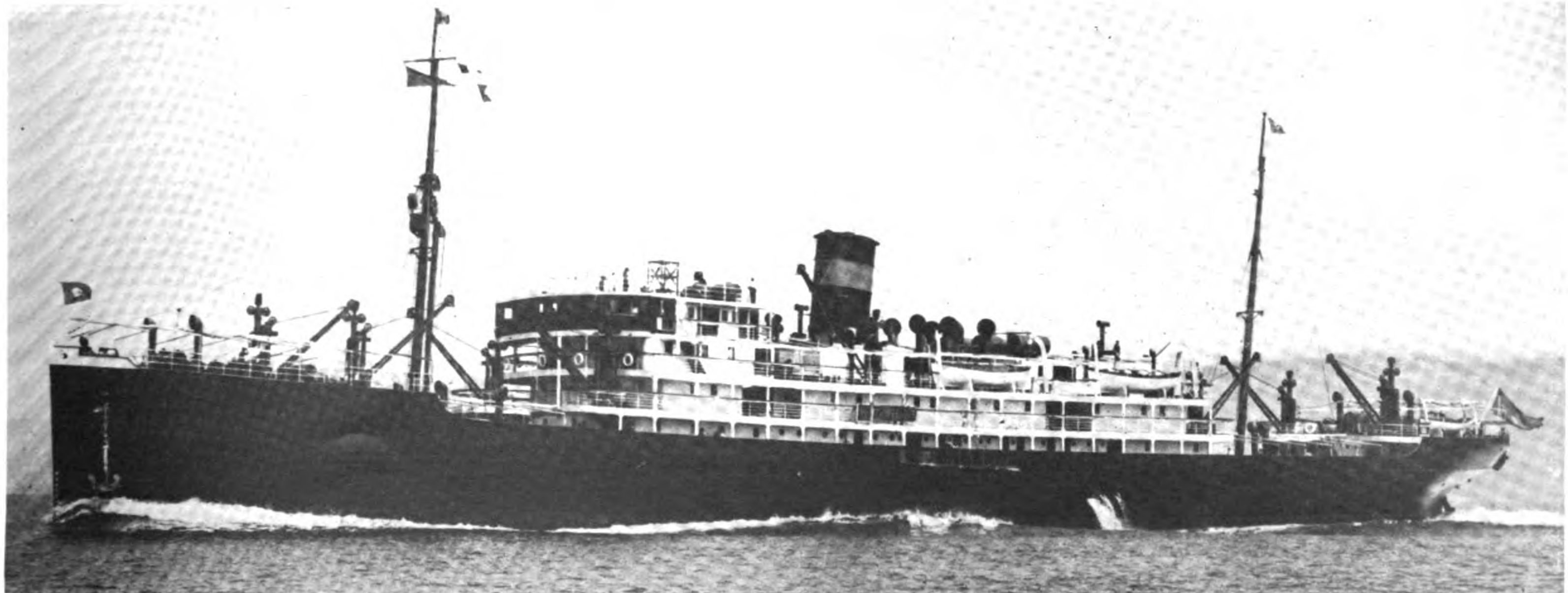
COASTWISE motorshipping differs in its principal aspects from all other kinds of motorshipping and in its special characteristics is confined mainly to a few parts of the world. The United States, with about 4,000,000 tons of coastwise and intercoastal shipping is one of the biggest operators in this field. There is a tremendous seaboard to be taken care of. From the St. Lawrence to Key West; the Gulf Coast; the long stretches of the Pacific seaboard. Shipping on these coasts includes short run high speed passenger ships, big ocean-going intercoastal freighters and passenger ships.

Similar conditions exist on the Australian coastline, but coastwise shipping here has not been so widely developed. The New Zealand coast supports much coastwise traffic of short run nature. The Brazilian coast and the immense Amazon River are carrying an increasingly important volume of coastwise shipping. This will attain increasing importance as the Amazon valley becomes further developed.

Space does not permit of more detailed excursions into the realms of world coastwise shipping. The point we have to make here is that the economies of the motorship have made less impression on coastwise shippers in the United States than in any other country. And this in spite of the fact that America has the largest volume of coastwise motorshipping in the world and that ships' operation is more expensive in America than anywhere else in the world. To put it candidly, there seems to be an objection on the part of American coastwise shipowners even to investigate the potentialities of the Diesel.

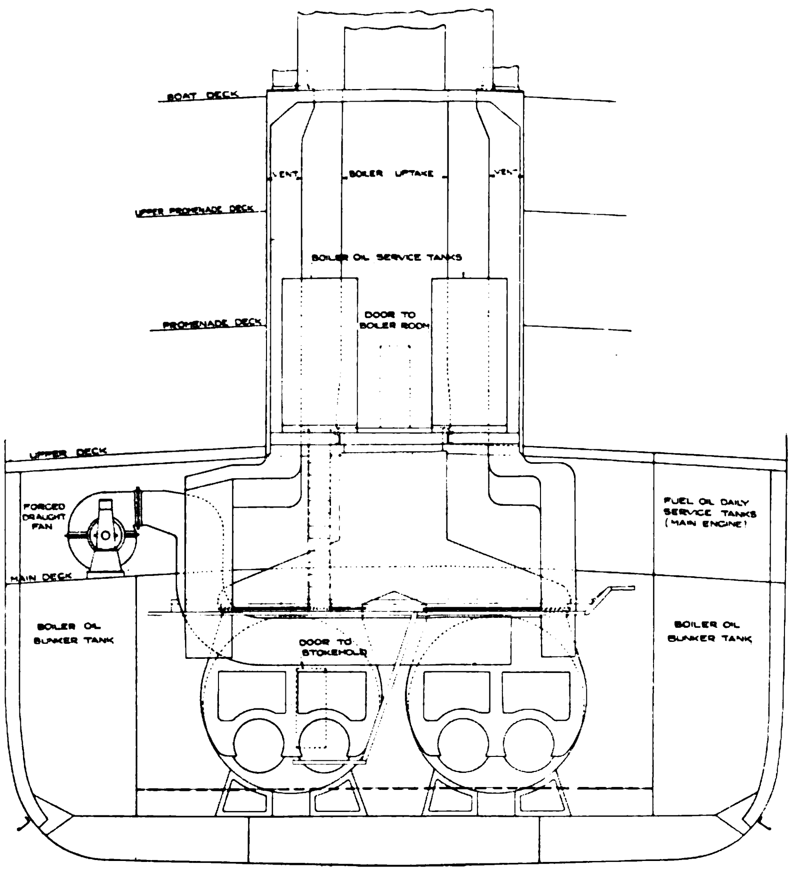
Let us narrow down the investigation to one particular type of ship in which there has been much activity in American shipyards during the last few years—the fast coastwise passenger and freight ship. It has been argued against the Diesel for such ships that it is too big for the relatively small size of hull, that it is impossible to obtain sufficient speed with the Diesel. It has been suggested that the ships are not at sea long enough to take advantage of the reluctantly admitted economy of the Diesel. It has been stated that the Diesel costs too much. We are disposed to protest strongly against all such criticisms except perhaps the last which stands partly justified because so many manufacturers have never had a chance of building on a production basis. It would seem that coastwise shipowners have condemned without giving engine builders a real chance to put a proposition before them.

Two of the biggest Brazilian coastwise shipowners, connected one with the other, we may note in this connection, recently determined that the motor coastwise passenger and freight ship presented economies which no steamers could give them. They have, at the present time constructed

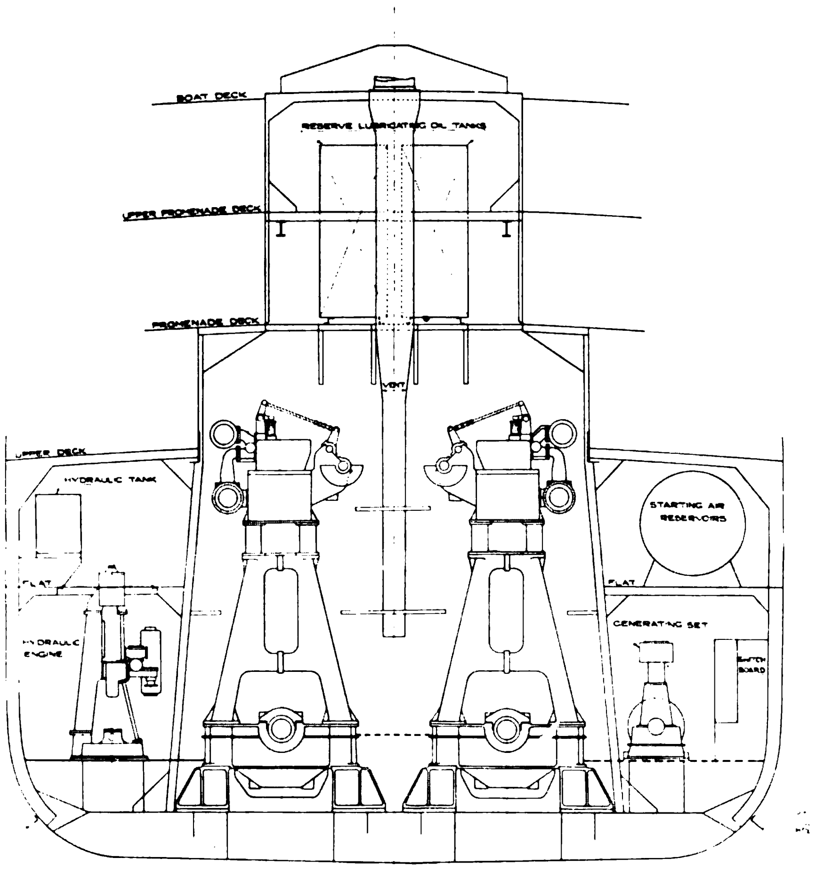


A modern fast coastwise freighter—Diesel powered by the Cant. Nav. Triestino, Italy—a 3500 *hp. motorship of the Lloyd Nacional Co., Brazil*

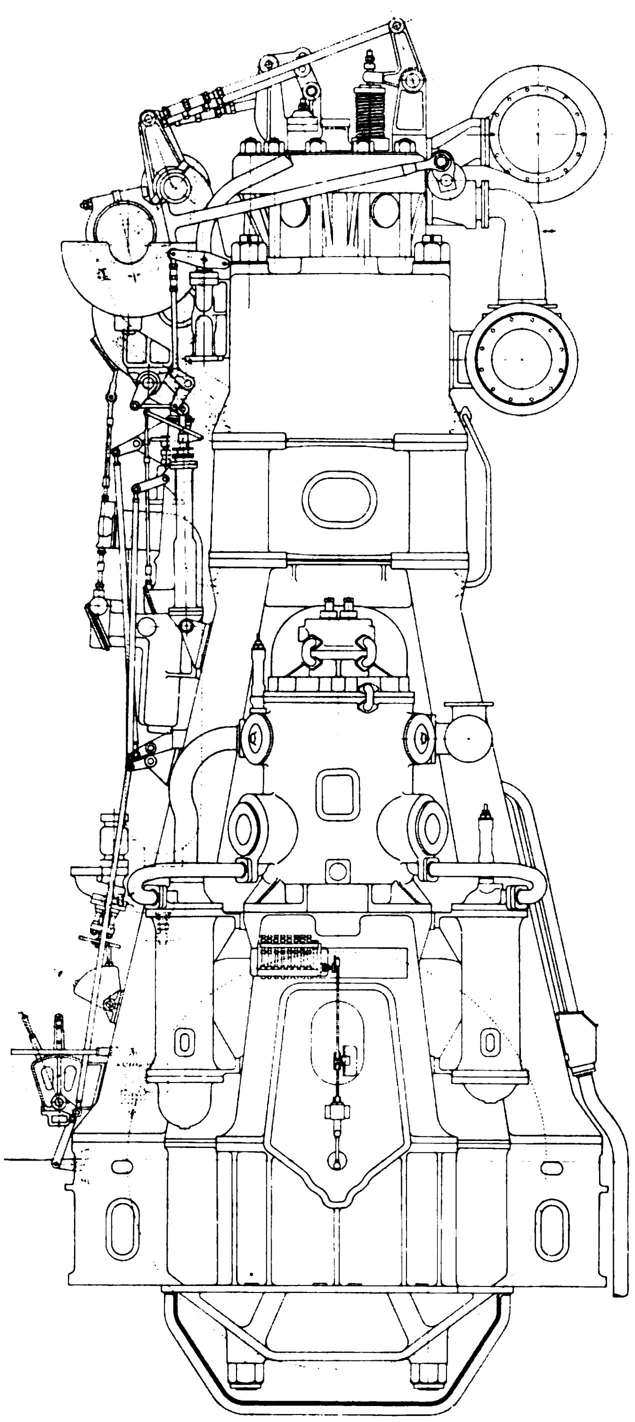
Machinery of the Companhia Nacional de Navegação Costeira New Coastwise Motorship Fleet of 14½ Knot Ships



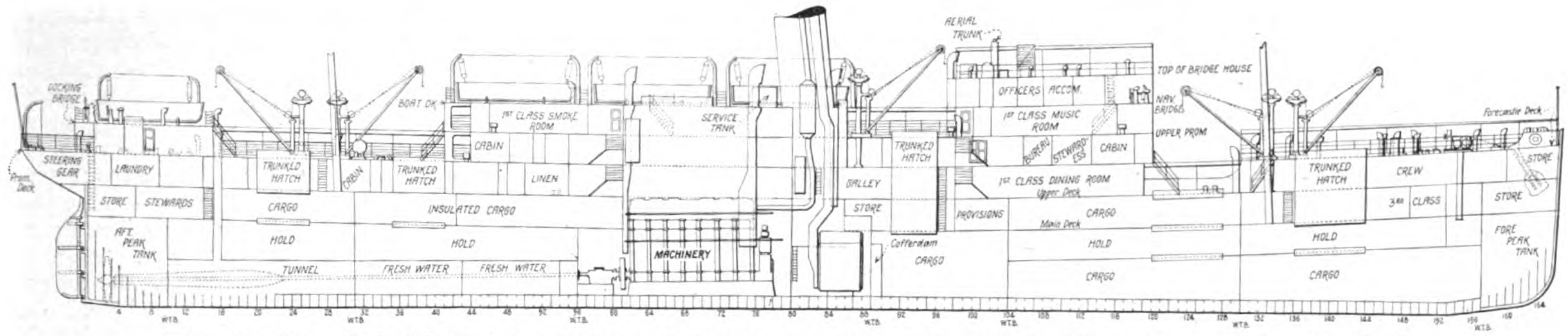
SECTION AT BOILER ROOM LOOKING FORWARD



SECTION AT ENGINE ROOM LOOKING AFT



End view of modified Beardmore-Tosi Diesel. Engine is rated for 1650 hp. at 135/40 r.p.m.

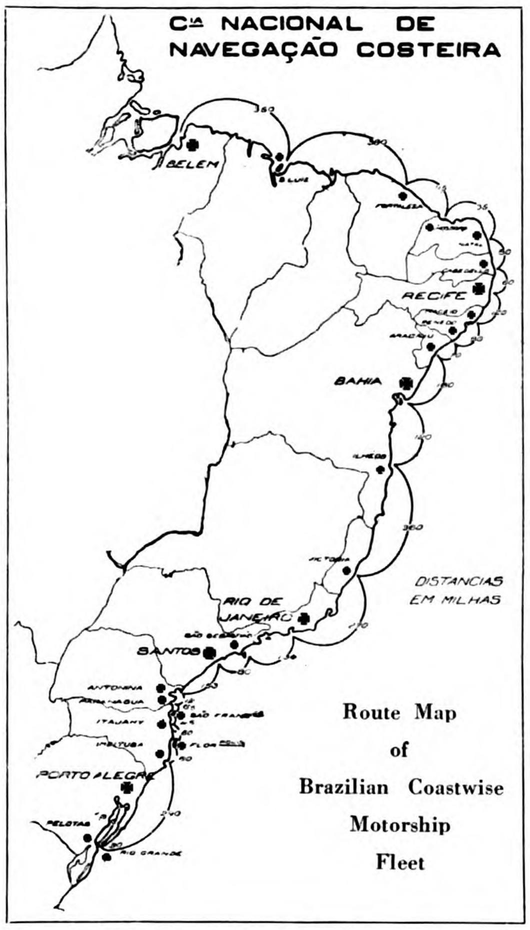


Inboard profile of the "Ita" class of 14½ knot Brazilian coastwise ships fitted with supercharged 4-cycle Diesels

or under construction no less than eight 14½ knot passenger motorships for service out of Rio de Janeiro to ports up and down the Brazilian coast as indicated on the attached sketch map. The two companies concerned are the Companhia Nacional de Navegacao Costeira, and the Lloyd Nacional Co. The former operates under government subsidy and its ships call at fewer ports than those of the Lloyd Nacional Co. This latter operates ships of larger cargo capacity but smaller passenger capacity. They maintain a slower schedule and call in at a greater number of ports than are touched by the Costeira ships.

Four ships have been constructed for the Lloyd Nacional Co. and these were all built at the Cantiere Navale Triestino Monfalcone, Italy. They are propelled each by two 4-cylinder Fiat Diesels each rated for 1750 b.hp. at 125 r.p.m.

Of the four ships for the Costeira Co., three were ordered from the Wm. Beardmore yard at Dalmuir, Scotland, while the fourth came from a French shipyard. The important point is that, as the table indicates, the Italian-built and the British-built group of motorships compare almost exactly in dimensions and power with two turbine driven coastwise ships now operating on the U. S. Eastern Seaboard. The principal item of interest in the Beardmore ships is the main propulsion equipment which consists of two sets of 6-cylinder single acting supercharged Beardmore-Tosi Diesels—the first supercharged British built marine Diesels. Each engine is rated at about 1650 b.hp. with normal induction when running at 130 r.p.m., but when running supercharged each engine is rated at 1850 b.hp. at 135/140 r.p.m. On the test bed in the shop the first engine was run supercharged up to 2200 b.hp. and maintained this power with perfect steadiness, normal combustion and exhaust temperatures and a clear exhaust. Each engine has cylinder diameters of 26 in. with a stroke of 43¼ in.



Route Map of Brazilian Coastwise Motorship Fleet

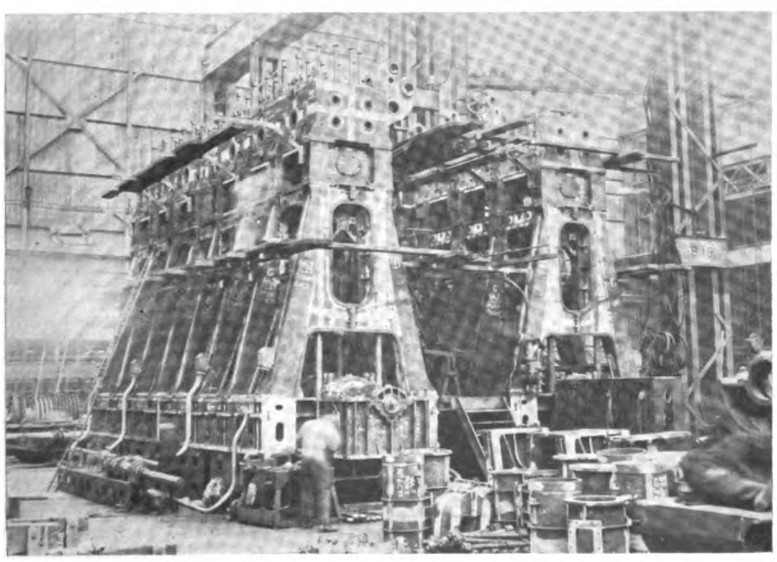
The framing consists of box section A frames, the crosshead guides being of the 4-slipper type, instead of the more usual single guide plate with astern bars, ensuring steady running conditions at all speeds.

A departure is to be noted in the design of the cylinders and valve gear. The cylinders are arranged in the form of an entablature cast in two pieces with three cylinders in each. The two parts are bolted together and the entablature thus forms a strong top girder.

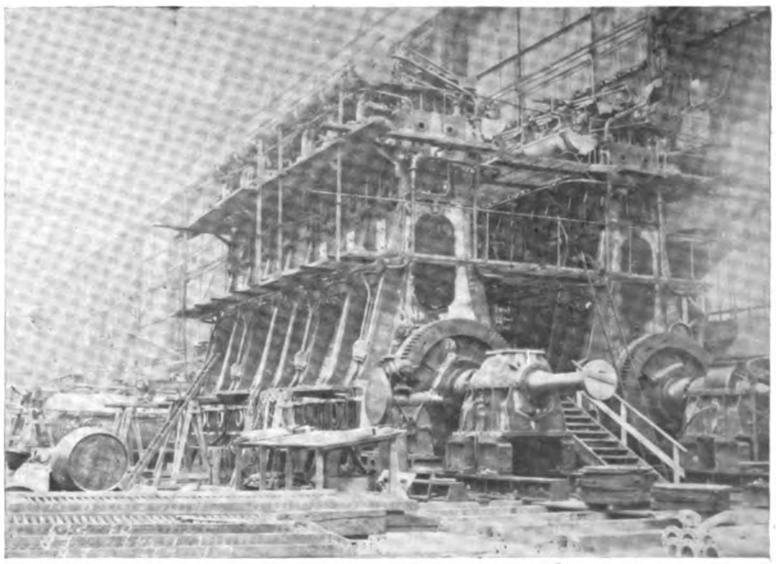
Each cylinder head has the usual number of valves, i.e., one fuel injection valve, two combined inlet-exhaust valves, one starting air valve and one relief valve. The valve gear, however, has been arranged so that the valves are actuated by pull rods which receive their motion from levers pivoted on a fulcrum shaft. This permits of the camshaft being arranged along the front of the engine at a lower level than usual, and in the case of opening up a cylinder for examination or overhaul, it is not necessary to interfere with the fulcrum shaft and levers or with the valve timing. The piston cooling gear is of the jet type embodying the Beardmore unpacked system of pipes. The pipes are surrounded by a cast iron chamber, which eliminates chance of piston cooling water contaminating the lubricating oil by leakage into the main crank chamber. Similarly the diaphragm plates under the cylinders prevent carbon from falling into the crank chamber.

The main engine crankshaft is of the built type, the crank pins and main bearing journals being shrunk in. A 3-stage injection air compressor is fitted at the forward end of the engine, as is usual, and worked from an extension of the crankshaft. It is of the crosshead type and each cylinder is fitted with a separate cast iron liner.

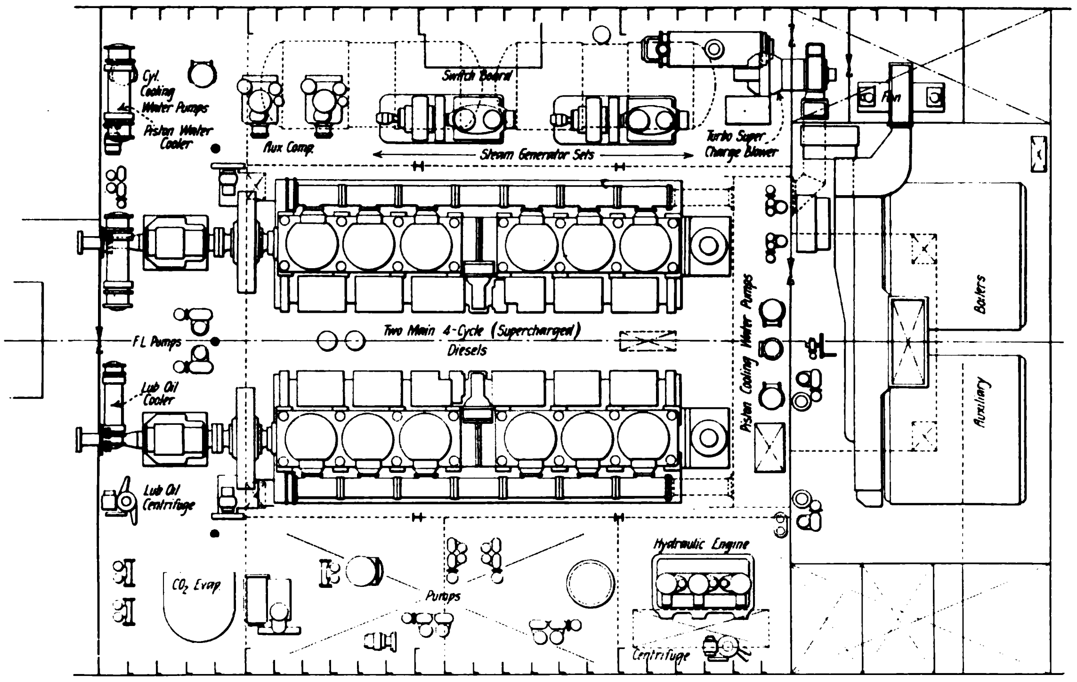
For control there are two starting levers, each controlling three cylinders through the medium of a small assistant air cylinder



Beardmore-Tosi Diesels completing at Dalmuir



Power plant of "Ita" class motorship on test block



Diesel main propelling plant and steam auxiliary plant of "Ita" class motorships

Trial Results

Coastwise Motorship of 5000 Gross Tons with Supercharged Diesels

	Condition 4 Hrs. with Supercharge	Condition 2 Hrs. Run	Condition Measured Mile
Total i.hp.	4780	4370	5450
Total b.hp.[1]	3625	3320	4072
Av. r.p.m.	137	133	140.05
Av. exh. temp.	860 deg. F.	850 deg. F.	900 deg. F.
Inj. air press.	900 lb./sq. in.	900 lb./sq. in.	910 lb.
Supercharge—do.	25 in. water	——	25 in. water
Fuel over period	5925 lb.	2850 lb.	——
Fuel/i.hp./hr.	0.31 lb.	0.32 lb.	——
Fuel/b.hp./hr.	0.407 lb.	0.43 lb.	——
Speed	——	——	14.8
Boiler oil for steam aux.	4048 lb.	1400	——

[1]Deduced from Torsion meter.

Coastwise Motorships and Steamers Compared

Name	Service	Length	Molded Beam	Depth	Draft	Cross Tons	Power	Speed
Itape	Brazil Coast	370	52	26.7	20.0	5000	4370 I	14½ K
Ararangua	Brazil Coast	370	53.5	27.4	18.0	4900	3500 B	14½ K
Robert E. Lee	N. York-Boston	375.5	54.0	17.2	——	5184	4750 S	14½ K
	Phila.-Jacksonville.	387.5	54.0	31.5	18	5300	4200 S	13 K

which by means of levers, rotates eccentrics on the fulcrum shaft, so that the two cylinder groups can be run on air or fuel as required. Reversing is carried out by means of an ordinary reversing engine, which moves the camshaft fore and aft into the ahead or astern position. Interlocking gear is arranged so that the engine cannot be reversed until the valves are in the neutral position, i.e., neither air nor fuel. Also the fuel pump is cut out during the period of running on air.

Two separate cooling water systems are used, sea water for the cylinder jackets, exhaust pipes, and the main air compressor. Fresh water is used for the pistons, cylinder heads and exhaust valves, the water being pumped from a special double bottom tank through coolers to the engine, and returning to the double bottom tank.

Although differing somewhat in external appearance, both the Italian built and the British built ships have the same internal arrangement. The Italian ships are reported to have a slightly greater beam and molded depth as the table indicates, otherwise details of general arrangement are the same in all ships. All have a straight stem, counter stern, two pole masts and single stack. They are of shelter deck type with a forecastle, long bridge—above which are promenade and boat decks—and a poop. The poop is connected to the midship structure in the British-built ships. There are three cargo holds forward of the machinery space and two abaft, No. 3 hold being entirely sheathed with cross boarding for the carriage of salt.

Accommodation is to be provided for 280 passengers in first, second and third class. First class quarters are amidships and include a large dining room and a music room at the forward end of the midship erection and a smoking room and a veranda café at the aft end. Two refrigerated compartments have a total capacity of 20,000 cu. ft. These are in the 'tween decks and are to carry meat and fruit. Cargo is taken care of by 10 hydraulic cranes of 1½ tons capacity apiece, and two of 3 tons each serving No. 2 hold. An electric warping winch is fitted aft on the poop deck and a similar boat hoisting winch on the smoking room top.

The construction of this fine coastwise motorshipping fleet has been overlooked by Mr. John M. Campbell of Glasgow, the owners General European Agent.

Shipping Board Pump Bids

Bids were taken on March 29 by the United States Shipping Board from fourteen firms for the supply of motors and pumps for six ships that are to be converted to Diesel drive.

The bids dealt with twenty-six separate items, requests having been made by the Department of Maintenance and Repair, a branch of the Shipping Board, for figures on the pumps and motors, both separate and combined.

The bidders were the General Electric Company of Schenectady, Electro-Dynamic Company of Bayonne, N. J.; Crocker-Wheeler Manufacturing Company of Ampera, N. J.; Diehl Manufacturing Company of Elizabethport, N. J.; Bethlehem Steel Company of New York; Westinghouse Electric and Manufacturing Company of New York; Dayton-Dowd Company of Quincy, Ill.; Goulds Pumps, Inc., of Seneca Falls, N. Y.; Hayes Pumping and Manufacturing Company of Boston; Kinney Manufacturing Company of Boston; Nash Engineering Company of South Norwalk, Conn.; Northern Fire Apparatus Company of Minneapolis, Minn.; Schutte & Koerting of Philadelphia and Worthington Pump and Machine Company of New York.

Fairbanks-Morse Moves Offices

The Eastern executive offices, export sales offices, and New York district sales department of Fairbanks-Morse & Company have been moved to 160 Varick Street, New York City where they also maintain a show room. The building is known as the Fairbanks-Morse Building.

Worthington Moves Offices

The executive offices of the Worthington Pump & Machinery Corp., as well as its export sales department and New York district sales department will be moved to No. 2 Park Avenue, New York City, on or about April 1. The head office sales and advertising departments have been moved to the Harrison plant of the Corp., located at 421 Worthington Ave., Harrison, N. J.

"Diesel Electric Drive"

"Diesel-electric Drive For Tankers" is the title of a new booklet published by the General Electric Company of Schenectady, N. Y. It contains some very interesting information concerning this type of propulsion besides illustrations and drawings.

Another Diesel Ferry for Vancouver Harbor

West Vancouver municipal council is considering the purchase of a large, new Diesel engined ferry boat similar to those already employed in the company's service. The vessel as planned will be capable of accommodating 375 passengers under cover—the largest ferry boat to be placed in service between Vancouver and West Vancouver.

The most recent addition to the service of the West Vancouver ferry system is the West Vancouver No. 6, which was built by S. R. Wallace at North Vancouver in accordance with designs by T. Halliday. This ferry is 100 ft. b.p., 18 ft. beam, has a draught of 6 ft., and is equipped with a 6-cylinder Atlas-Imperial Diesel engine capable of developing 200 hp. at 300 r.p.m. This vessel has a speed of 10 knots, and a fuel consumption of approximately 6¼ g.p.h.

Safety in Engine Design

Torsional Vibration in Engine and Propeller Shafting—Its Determination, Causes, and Effects on Marine Diesel Engines

It is now twenty-six years since Dr. Gümbel, in a paper read before the Institution of Naval Architects in London, pointed out the dangerous stresses that might be caused in marine engine shafting by synchronism between a harmonic component of the engine turning moment diagram and one of the natural periods of torsional vibration of the system comprising engine shafting and propeller. The engines referred to in Dr. Gümbel's paper were the old triple expansion type—at that time in many cases subject to trouble from intermediate shaft breakages which Dr. Gümbel proved to be due almost invariably to critical conditions of torsional vibration caused by the synchronism at normal speed of the three per revolution component of the engine torque with the lowest, or single node, natural frequency of the shafting system.

In the years immediately following Dr. Gümbel's original paper many workers, and in particular Dr. Trahm, carried out careful experimental investigations into the subject and these fully confirmed the importance of a very full study of the subject.

Dr. Gümbel considered that the vibrating system consisted of two masses, the engine and the propeller connected by a weightless shaft, and it is evident that such a system can have only one type of vibration with a single node between the two masses. It is equally clear that the actual system to be considered is much more complex and consists of a number of masses connected by flexible shafting and has therefore a number of modes of vibration. In 1908, in a paper read before the Institution of Civil Engineers in London by Millington, Chree and Sankey, methods were given whereby the critical speed of systems having two, three or four masses might be calculated. Such expressions suffice for the calculation of the vibrations of a triple expansion engine where there are only four main rotating masses—the mass at each crank and the propeller mass—but they fall short of the requirements of the oil engine where there are four or more cylinders, a flywheel and a propeller.

It is not until 1922 that we find the subject carried much further. In that year the troubles of double reduction gearing led to investigations of the coupler vibrating system which is present when a number of turbines drive a common propeller shaft through reduction gearing.* In the same year Dr. Gümbel published some further work‡ giving graphical methods of calculation and at the same time introducing the effect of clamping devices on a vibrating system. Last year in a paper read before the Junior Institution of Engineers* methods were given by means of which the natural frequency of systems having as many as nine masses were given for airplane engines having various arrangements of shafting between engine and propeller. It is evident that these formulæ might equally well be used for marine oil engines as for airplane engines, nothing being essentially different except the size. All of the work yet published has had as its object the calculation of the natural frequency and the avoidance of its synchronism with any forced vibration, but it would be preferable to have a method of calculating directly the torque caused in the propeller shafting by any particular frequency of forced vibration. Consider first a simple system having only two masses of inertia I_1 and I_2 connected by a shaft of rigidity $C_{1\cdot2}$ subject to a forced vibration whose frequency is "K" and whose amplitude is T_{v_1} sin. $(2\pi\kappa t)$. Assume that this force is applied to the mass I_2 in the system and causes a vibration having an amplitude of α radians at the mass I_1.

It is evident that:

$$T_{v_1} = (2\pi k)^2 \alpha \left\{ (I_1 + I_2) - \frac{I_1 I_2}{C_{1\cdot2}} (2\pi k)^2 \right\} \qquad 1$$

substituting K for $2\pi k$ we get

$$T_{v_1} = \alpha K^2 \left\{ (I_1 + I_2) - \frac{I_1 I_2}{C_{1\cdot2}} K^2 \right\} \qquad 2$$

the torque variation "Q" in the shaft is given by

$$Q = I_1 K^2 \alpha \qquad 3$$

$$\text{but } \frac{1}{\alpha} = \frac{K^2}{T_{v_1}} \left\{ (I_1 + I_2) - \frac{I_1 I_2}{C_{1\cdot2}} K^2 \right\} \qquad 4$$

substituting 4 in 3 we get

$$Q = \frac{I_1 T_{v_1}}{(I_1 + I_2) - \frac{I_1 I_2}{C_{1\cdot2}} K^2} \qquad 5$$

By the same process for a three mass system with masses I_1, I_2, I_3 and shaft $C_{1\cdot2}$ and $C_{2\cdot3}$ we get:

$$Q = \frac{I_1 T_{v_1}}{(I_1 + I_2 + I_3) - \left(\frac{I_1 I_2}{C_{1\cdot2}} + \frac{I_1 I_3}{C_{1\cdot2}} + \frac{I_2 I_3}{C_{2\cdot3}} + \frac{I_1 I_2}{C_{2\cdot3}} \right) K^2 + \frac{I_1 I_2 I_3}{C_{1\cdot2} C_{2\cdot3}} K'} \qquad 6$$

In this case Q gives the value of the torque variation in the shaft $C_{1\cdot2}$. The torque variation in the shaft $C_{2\cdot3}$ would be given by replacing I_1 by I_3 in the numerator.

Examining expressions 5 and 6 above it will be found that the denominator in each is the expression for calculating the natural frequency of the system to which it refers. If then we use as denominators the expressions given in Mr. Calderwood's paper before the Jun. Inst. E. and as numerator the expression I_P T_{v_1} we can calculate for any system the torque variation caused in the propeller and tunnel shaft by engine turning moment components of any frequency and amplitude. Throughout the above no mention has been made of the method of calculating the moment of inertia of the masses and the rigidity of the various shafts. To consider first the masses:

The propeller inertia can easily be found by calculating the inertia over sections of thickness "dr" at various points between the centre and the blade tip. A curve can be drawn of these inertias and the area integrated will give the total moment of inertia of the propeller. The propeller is however rotating in a heavy fluid—water—and this will cause an apparent increase in inertia. This increment will vary with a number of conditions, namely, the blade thickness, the weight of the propeller material, the pitch ratio, and the amplitude of vibration. An average figure for the increment would be 30 per cent of the actual propeller moment of inertia. This should be altered in the following way according to conditions:

(a) For very thick propeller blade decrease about 3 per cent. For very thin propeller blade increase about 3 per cent.

(b) Bronze propellers decrease by about 3 per cent. Cast iron propellers correct.

(c) Very high pitch ratio (say 1.8) increase about 3 per cent. Very high pitch ratio (say 0.8) decrease about 3 per cent.

(d) Very heavy vibrating forces (4 cyls. 4 stroke engine) increase about 4 per cent. Very low vibrating forces (10 cyls. 2 stroke engine) decrease about 2 per cent.

In a case where all the conditions which increase the increment are found in conjunction it may reach a value of about 40 per cent, while if all the conditions which tend to reduce it occur together it may be as low as 20 per cent.

The calculation of the flywheel inertia is quite straightforward and requires no special comment.

For the determination of the moment of inertia at each crank the moment of inertia of the rotating parts must first be calculated, to this must be added the moment of inertia caused by a mass at crankpin radius consisting of:—the total weight of the big end bearing + 0.75 of the connecting rod weight + $\frac{2}{\pi}$ of the weight of top end, crosshead, piston rod and piston. The resultant figure will give a very close approximation to the average moment of inertia at each crank, and while it is not absolutely accurate to use this average figure in natural frequency calculations, the approximation is sufficiently accurate to allow of a very close estimate (say within 3 per cent) at any rate of the 1st and 2nd degree natural frequency while the error even in the higher frequencies is not large. To take into account the effect of the variable inertia throughout the revolution at each crank involves a very long and difficult calculation and the improvement in accuracy does not justify the extra calculation work involved.

The determination of the torsional rigidity of the shafting between engine and propeller is perfectly straightforward and need not be discussed here. The crankshaft rigidity is more complex; here the rigidity between the center lines of each pair of cylinders must be calculated, and the effect of twisting in the journal and of twisting and bending in the webs and pin must all be taken into account. It will usually be found that the rigidity between cranks on a shaft of normal construction is some 20 per cent to 30 per cent below the rigidity of the plain part of shaft in the journal and in cases where a preliminary critical speed calculation has to be hurriedly carried out very little error will be introduced into the calculation if the rigidity of the shaft is estimated on this basis.

As regards vibrating forces that may arise from engine torque, forces of a number of different orders will be of importance and to obtain these the turning moment diagram of the engine as a whole (including effects of inertia of reciprocating parts, etc.) should be harmonically analyzed, and the components treated as separate vibrating forces of the

* { I.N.A. Transactions. Vol. LXIV.
N.E. Coast Inst. E. & S., Vol. XXXIX.

‡Z d. V.D.I. No. 11, 1922.

* J. I. E. Vol. XXXVII. "The Investigation of Torsional Vibration," by J. Calderwood.

types T_{V_1} sin. $(2\pi\kappa_1 t)$, T_{V_2} sin. $(2\pi\kappa_2 t)$, T_{V_3} sin. $(2\pi\kappa_3 t)$, etc. Further to this the turning moment diagram from one cylinder should be analyzed separately and the same components obtained, as it must be remembered that uneven balancing of power may give at times a particularly marked effect to the forces from one cylinder. Any of the above components having an amplitude such that T_V is more than 10 per cent of the mean torque will be sufficient to cause serious stresses in the shaft if they should be near synchronism with a natural frequency. The stresses in the shaft caused by each such component should be calculated over the range of speeds at which the engine runs normally, as has been described in the equations above, and any speed at which one of the components added to the mean torque causes dangerous stresses, should be avoided.

Calculations of critical speeds are of equal importance in the case of auxiliary machinery, as frequent trouble has been experienced with such sets, and 6-cylinder generators have frequently had crankshaft failures from this.

The serious consequences of failing to consider this particular branch of design was recently illustrated by the breakage of the shafting on a large passenger liner fitted with steam machinery; as the result of this breakage one engine was wrecked, and there can be little doubt that the first cause of the trouble was torsional vibration.

Recent Diesel Engine Literature

"Land and Marine Diesel Engines"

"Land and Marine Diesel Engines," by A. P. Chalkley is published in its sixth (1927) edition, the first one having appeared in 1911, when Diesel engines were isolated phenomena and books about them were rarities.

A correct estimate of a book which has gone into six editions and several reprintings as the accepted "Bible" of the subject which it covers, is not easily arrived at. Overshadowing the actual contents of the book, as well as its real merits or demerits, are just two outstanding facts: The Diesel engine has marched triumphantly to success since the first edition was published and at every stage of the progress, a new edition of Chalkley was there to present arms.

Attempts to evaluate the current edition of the book, if they are to be at all successful, must, therefore, be addresed to one class of readers which has watched the Diesel engine from its earlier inceptions with one edition or an other of Chalkley under its arm, and to another class of inquirers whose more recently awakened Diesel-consciousness is making them ask for latest information in keeping with the contemporary stages of progress.

The older readers of Chalkley will want to know what is new in the present or sixth edition. Some of the chapters, notably the first one, ambitiously labeled "General Theory of Heat Engines," has successfully withstood the solvent action of time since the very earliest editions. It still bristles with Pv^n and states blandly that "the temperature rises a good deal after the injection of fuel." Substantially no notice is taken of modern researches in thermodynamics directed towards finding an ideal standard efficiency-cycle — like the Rankine cycle for steam engines — against which to measure efficiencies actually realized in Diesel engines, and vexatious questions like variation in specific heat at high temperature are smothered in the thick masonry of silence. In the chapter on "General Theory" it is propounded that temperatures in Diesel engines must be lower than in gas engines because in the latter combustion occurs suddenly without opportunity for the transmission of heat to the cooling water. The impression is thus created that because the flame of combustion proceeds for a greater length of time in the Diesel, more heat escapes to the cooling water and hence the engine runs cooler. Possibly this might be justified on the ground that the chapter in which it occurs is "theoretical," but even theory takes account of the transmission of heat through the metal of the engine as a critical factor in the Diesel technology of today.

The sixth edition contains a 10-page chapter on airless-injection Diesel engines. Controversial matters like Plain Combustion Chamber versus Pre-Combustion Chamber are avoided, the reader being finished off with the bare information that airless-injection engines are thus actually subdivided into two broad classes. Discreet silence is also maintained in regard to atomization, penetration and turbulence.

The chapter on "Construction of the Diesel Engine" is now subdivided into four dealing with 2-cycle, 4-cycle, single-acting and double-acting engines. These are well illustrated with plentiful drawings from the contemporary technical press.

The book contains 320 8¾ in. x 5¼ in. pages with 206 illustrations and is published by D. Van Nostrand & Co., New York. It is obtainable from MOTORSHIP, Technical Book Department.

Mechanical Vibrations

With the rapidly increasing demands for Diesel engines of lightweight per horsepower measuring up to high performance standards, higher rotative speeds and a more intensive utilization of constructional materials appear to be the outposts of modern Diesel engine progress.

In the past it has been customary to lay out Diesel engine designs on an essentially static basis, taking little account of the mechanism as it suffers elastic deformations in response to the working forces to which it is exposed. The realization that the dimensions and contours of the unloaded machine at rest may under some circumstances be critically different from those which it momentarily takes on during the many phases of its working cycles, has signified a forward step of cardinal importance.

A second great forward step in the working of modern high-speed, high-duty Diesel types appears to be based upon the realization that the periodic application of stresses to engine elements produces periodically varying deformation, more commonly spoken of as vibration. Just as the non-periodic deformations were found to produce strain conditions not ordinarily suspected, so it has been determined that stresses of an essentially vibratory nature are to be reckoned with by the designer who aims at the highest. That is the significance of Dr. Geiger's very important work entieled "Mechanisch Schwingungen" (Mechanical Vibrations, by Dr. Ing. J. Geiger. Published in Berlin, by Julius Springer, with 305, 6 in. x 9 in. pp., 290 illustrations and 2 charts).

The unusual prominence which has been given to that special class of mechanical vibrations which sometimes arises in crankshafts and are of a torsional nature has tended to obscure the fact that engine stresses other than torsion are nearly always periodic and frequently also set up vibrations. It is true, of course, that torsional oscillations are by far the most important of all mechanical vibrations, so far as Diesel engine work is concerned. Dr. Geiger, however, in his characteristic thorough way, approaches the subject on a broad basis, marshalling the fundamentals pertaining to the general case where periodic forces and periodic deformations are concerned. As an illustration of non-torsional vibration that are met with in practice may be mentioned the bending deflection of engine framework that results from unbalanced reciprocating masses and that reaches a critical maximum at definite engine speeds exactly as did torsional oscillations. It has been reported, also, that the bending strains set up in a misaligned rotating shaft may get into a certain relationship with the natural bending frequency of the piece, resulting in its destruction by repeated bending much more rapidly and at considerably lower apparent stresses than could be explained in the usual way.

Although it might have been expected that the treatment of such subjects as these would be almost exclusively mathematical, Dr. Geiger has, nevertheless, succeeded in tying them down to earth by means of the remarkable vibration measuring instruments devised by him and used in practice for checking his mathematical deductions by the behavior of actual machines. One of the most valuable portions of the book is concerned with the description of these instruments, their application, and the graphic records reproduced from them.

Westinghouse Catalogue of Electrical Supplies 1928-1930

Publication of the 1928-1930 Catalogue of Electrical Supplies of the Westinghouse Electric and Manufacturing Company presents electrical and mechanical features and application information for all supply apparatus and appliances manufactured by the Westinghouse Company, and in addition describes and illustrates a representative list of large motor and generating apparatus.

New equipment and modifications of former designs described cover a wide variety of applications, such as Instruments and Relays, Switchgear, Traction, Marine, Aviation, Farm Lighting, Motor Apparatus and Prime Mover apparatus. The new catalogue contains approximately 1,200 pages.

American Hammered Piston Ring Co. reports business for January, 1928, 40 per cent greater than January, 1927.

The Duct Keel system has now been incorporated in the construction of 91 ships totalling over 1,000,000 tons, including the large motorship SATURNIA and many other first class motorvessels. This system offers a very satisfactory method of dealing with bilge pipes, oil fuel pipes, ballast tank pipes and fuel pipes.